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Mobilization Plans of the Bridgeport Ordnance District

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A practical application of the general plan of industrial mobilization

Readers of the *American Machinist* will recall several feature articles on Industrial Mobilization that have appeared during the last three years. Secretary of War Davis and General Williams were the authors and their aim was to acquaint industry with the general plan. Now, their work is beginning to show results. This account of what the Bridgeport Ordnance District has accomplished shows that the plan is thoroughly practical. The progress of other ordnance districts will be covered in other articles to be published later

AN ARMY requires hundreds of thousands of items of supply, many of which are of special designs not produced commercially in time of peace. The quantities involved are far beyond the capacity of government establishments to produce. Seven branches of the service, the Quartermaster Corps, Ordnance Department, Signal Corps, Engineer Corps, Medical Corps, Air Service and Chemical Warfare Service, are concerned with the procurement of the different classes of material, and are charged with the development of the procurement plans under the supervision of the Assistant Secretary of War and with the cooperation with the manufacturing plants of the country.

For efficiency in dealing with industry, the War Department has divided the country into fourteen procurement districts, based upon lines of industrial activity and has planned for the decentralization of procurement, production and inspection of material by organizing in each district an agency for each branch of the service to deal directly with the manufacturers. The Ordnance Department maintains in each district an office directed by a prominent business man as District Chief, assisted by a Regular Army officer as Executive Assistant, whose duty is to develop plans for securing from manufacturing plants in his district such war munitions as may be allocated to that district by the Office of the Chief of Ordnance. The Bridgeport Ordnance District, including the four western counties of Massachusetts and the state of Connecticut was established in January, 1923. Containing as it does many large producers of firearms, ammunition, fine tools and machinery, and numerous brass mills and screw machine plants, it follows that the orders allocated by the Ordnance Department to the Bridgeport District Ordnance Office consist mainly of pistols, machine guns, shot guns, small arms ammunition, metal components for artillery ammunition, and brass raw material, with the possibility of future allocation of gages, special machine tools and many small screw machine products.

The mobilization plans of this district therefore deal with expansion of existing facilities and organizations to produce articles relatively similar in type to those commercially produced—a proportionately small volume of material upon which a proportionately large amount of work must be done. The development of an industrial mobilization plan depends upon the degree of similarity of the war requirements to the commercial production, upon the character of industry within the district limits and

upon the adaptability of the organization with which the district has to deal.

Industrial preparedness, if the term is to be significant, indicates that industry is familiar with the drawings, specifications and manufacturing information covering the definite articles to be produced by it in an emergency and that it has by actual planning determined its requirements in machinery, power, labor, transportation and material, has laid out definite processes of production and has actually produced some of the material as proof of its ability to function rapidly and efficiently when the call comes.

Preparedness further signifies that all secondary requirements have been studied and that they are obtainable in the quantities necessary to meet basic needs, that strategic materials have been studied with a view to determining their availability, or suitable substitutes, and that the entire scheme, from raw material through all the intermediate stages of procurement and production to the finished articles in the hands of troops, presents a logical program all parts of which are within the possibilities of all agencies involved.

Flexible Industrial Organization

Solutions of the problems of power, transportation, labor and finance must be available, and the entire project must permit of ready and convenient revision periodically in all of its essential details. Appropriate sources of supply for secondary requirements must be selected with a view to regulation of transportation and priorities, and in order to keep the war-time plans as close to normal business lines as conditions will permit. This not only permits of a more rapid and efficient transition from peace to war production but also allows a continuance of customary business interrelations and should facilitate a return to commercial work after a war with the minimum loss of pre-war business.

The conversion of manufacturing plants from commercial to war time production involves rearrangement of facilities, the installation of new machinery, the design and production of special tools, dies, jigs, fixtures and gages, the expansion and development of the plant organization and the employment and training of quantities of labor generally unfamiliar with the type of production required of it.

There is a definite rate and limit of expansion which cannot be efficiently exceeded. There is an appreciable time required for the training of unskilled labor and a limit to its ultimate efficiency which is probably between fifty and seventy-five per cent of peace-time labor. Time is required to design and build the special machinery and tools without which no wheel can turn in the production of the actual munitions. Other considerations impossible to foresee will arise to still further delay the attainment of maximum war production.

The knowledge of war production now possessed by industry will be gradually lost to the government with the passage of the individuals possessing that knowledge, unless it is perpetuated in the form of active, usable records and instructions. The value of these records lies in their application to definite plants and processes and for this reason they should be in the form of factory plans prepared by the manufacturers who will probably produce the articles in question.

The industrial mobilization plans of the Bridgeport Ordnance District are based on the perpetuation of the valuable information gained during the past war, and upon the anticipation of those problems of preparation and conversion which are least liable to frequent change, and which will involve loss of time if not intelligently provided for in advance.

In order that the information pertaining to any plant shall be of value and shall indicate a definite condition, the information must be furnished by the plant itself and must represent a definite study of existing conditions. It is therefore necessary to convince the manufacturer that any work he may do in planning would materially cut down the time necessary to get into production in case of actual emergency. He must be reasonably assured of producing the article in question in case war should actually come. He should be asked for only such details as will involve a loss of time or a delay in production unless planned in advance, but should not be asked for details that are subject to change in the natural course of his commercial production nor for studies that can be more quickly and accurately made when the actual production starts. He should be asked for definite estimates on definite articles and should not be asked for general information unless it is required in the development of a definite study.

The first step in planning is the determination of requirements by the Ordnance Office and the apportionment of the total requirements to the field agencies, calling for definite articles according to a definite monthly schedule calculated to satisfy the needs of troops. The field agency or procurement district office takes these schedules, accompanied by drawings and specifications, to the selected manufacturing plant, and determines by a conference with the plant officials just what portion of the schedule is suitable for the plant to undertake, and requests an engineering study of all the important phases of the problem.

Preparing for Peak Demands

In presenting schedules to a manufacturer, the Government should realize that it is impossible to start production of a special article on five minutes' notice and that it is impossible to increase plant capacity beyond a certain rate or beyond a certain point and still maintain satisfactory quality. Procurement schedules should build up at a reasonable rate to a reasonable maximum and maintain that maximum throughout the life of the order. The building up to a very high peak and the subsequent falling off involve difficult problems of production and planning in the plant which do not coincide with usual commercial practice and are therefore a source of annoyance to the plant in making its war plans.

The development of factory plans in this district was initiated at a meeting of representatives of the principal producers who had accepted war order allocations. The District Chief outlined the information desired and the reasons for preparing factory plans and called upon the manufacturers to co-operate to the fullest extent possible. The manufacturers in each case designated a representative of their company by title to co-operate with the district office and to furnish all information desired. By this step, changes in personnel in the plant will not shelve the Ordnance plans but will cause their being passed on to the proper successors. After this meeting, all plants were furnished with a statement showing the information desired, and each plant furnished a general estimate of requirements which formed the basis of further dealings with the designated rep-

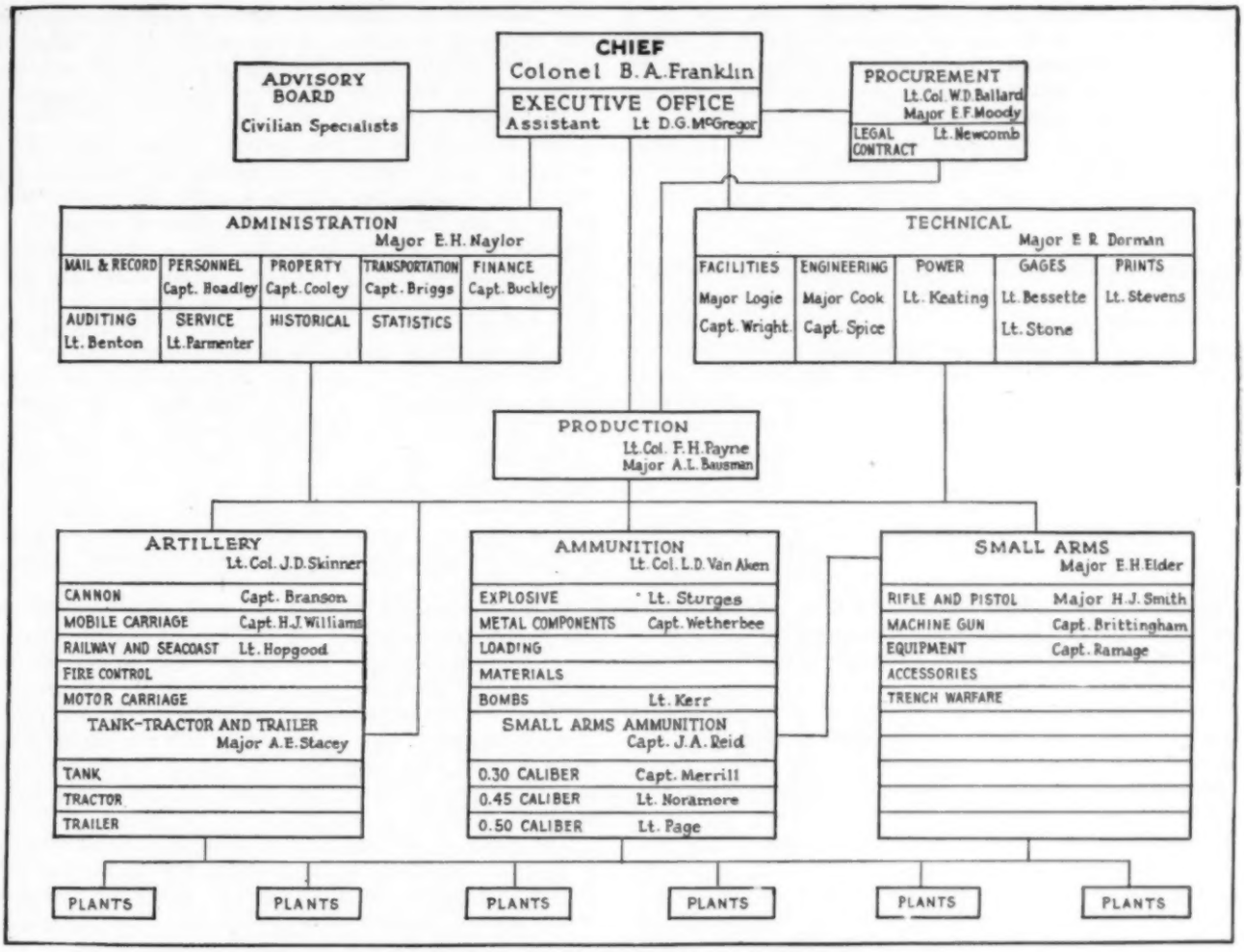

Fig. 1—Organization Chart of the Bridgeport Ordnance District

resentative of the concern to obtain more specific data.

A clear conception of the lines along which the Bridgeport District is working and the degree of co-operation offered by the manufacturing plants can best be obtained by studying in detail the factory plans of a large ammunition plant in this district. This company has received and accepted the allocation of the following tentative orders, which are about ten times the normal peace time possibilities of the plant in question:

0.30 Caliber Ammunition, a maximum of 90,000,000 rounds per month;

0.45 Caliber Ammunition, a maximum of 10,000,000 rounds per month;

0.50 Caliber A. P. Ammunition, a maximum of 3,000,000 rounds per month.

The preparation of this plan was turned over to the chief engineer and under his supervision all past records of performance and present methods of operation were gone into, estimates of machine capacity were determined, secondary requirements outlined, and studies of new construction, power, transportation, labor and material were made.

The complete round of ammunition was first separated into its components, the bullet jacket, slug, cartridge case, primer, and loading. Each component was then divided into operations. One chart was prepared to show, for each operation, the machine capacity or machine-hour rate, type of machine, total machines required to give the scheduled production, machinery of suitable type now in operation, and machines to be secured. A second chart showed for each operation the tools, dies and fixtures required, the life of these tools, and a list of tool room equipment necessary to maintain these tools in service. A third sheet showed operations to be gaged and the number and types of working gages required. A fourth sheet showed labor requirements and a fifth the transportation requirements in cars per month to ship the completed articles.

A consolidated list of all machine tools to be secured, and of all raw and semi-finished materials, including packing material, was submitted to the purchasing division of the plant for selection of customary sources of supply.

The machinery schedule contained an estimate of floor space and a consolidation was prepared to show new construction necessary and tentative assignment of operations to existing buildings where practicable.

This plan required about one year to prepare and when completed was forwarded to the district office for further development. It is so drawn up that changes in type of material, or in the organization and equipment of the plant, can be introduced into the plan with very little effort as occasion arises, and periodic revision of all details can be rapidly and accurately made so that it will represent at all times an up-to-date picture of the production of small arms ammunition.

While this is the most complete and accurate plan received by the Bridgeport District, several other plants

have prepared studies along similar lines, and it is intended that eventually all articles allocated on orders that may be placed in emergency will be covered by factory plans similar to that just described. The co-operation of industry has been most gratifying, and it is felt by all concerned that if time is to be spent in these studies, the results should be as definite, as accurate, and as ready of periodic revision as possible.

Subcontracts

Upon receipt of the factory plan covering the basic articles of issue, the Bridgeport District must make up subcontract schedules for all components, machinery and material including packing material and interview the sources of supply selected by the so-called prime contractor, placing with these sources that portion of the requirements that can be handled in each case and encouraging the subcontractor to study his own problem with the same degree of thoroughness represented in the prime contract study.

Factory plans for use in an emergency are required for all subcontract articles of a special nature in the same manner and to the same degree of completeness as for prime contract articles. Plans for commercial articles, where the quantities involved do not present problems of machinery and material, are not necessary at this stage of the game.

Many of the secondary sources of supply indicated by the prime contractor are in other procurement districts, and many are allocated by the Office of the Assistant Secretary of War, for priority, to other branches of the service. The negotiation of subcontracts therefore introduce inter-district and inter-branch correspondence.

In time of war it is probable that most of the secondary requirement will be obtained directly by the prime contractor without aid from the district office unless conditions arising at that time require such action. In peace-time planning, however, it is necessary for the district office to negotiate these subcontracts in order to determine the war load on the district, to regulate the distribution of all war material for the best interests of all branches, and to prevent overloading of any facility.

The negotiation of subcontracts further permits close co-operation between the Government and a larger number of producers and enables studies to be made of new processes, new types of machinery and material, and estimates of total power, transportation and labor requirements.

Considering the factory plan described previously, from the standpoint of its subcontracts, the District Office prepared schedules of machine tools, raw material, components and packing materials, basing these schedules on the time required to produce them and transport them to the prime contract plant. These schedules include about seventeen hundred machine tools, from fifteen different plants distributed through six districts; propellant powder, primer composition, brass and gilding metal strip, lead for bullet slugs, steel cores for armor piercing cartridges, cartridge clips, bandoleers, paper boxes, tin linings and wood packing boxes.

These subcontract articles, in some cases, further subdivide themselves into machinery and material. For example, the cartridge clip involves presses, and brass strip; the steel core involves screw machines and steel rod, and the packing boxes involve wood-working machinery, nails, screws and lumber. Wherever special articles or new processes are necessary, factory plans are required, and wherever quantities of raw materials are large or difficult to obtain, advance planning is required, in order to assure an adequate supply of finished ammunition in the hands of troops at the front.

Subcontracts are of two general classes: first, those to supply requirements of a commercial plant and for which all negotiations will be handled in time of war by the prime contractor. Second, those to supply components which will be assembled under the control of the Government or of a district. These latter are similar to prime contracts in that the district in which they will be produced will be responsible for the inspection, payment and shipment to the assembly point.

When two or more branches of the service are interested in the same factory, it is important that negotiations be opened simultaneously, preferably by a visit to the plant of all field agents concerned. Subsequent dealings with the plant must be made a matter of inter-branch record. This is necessary to avoid confusing the manufacturer and to prevent overloading the plant with requirements from one service at the expense of the other.

In the Bridgeport District, the Ordnance Department has negotiated schedules for the Quartermaster Corps, the Chemical Warfare Service and the Signal Corps with jointly allocated plants, with results apparently satisfactory to the plants and to the services concerned. The advantage of this procedure is that the commercial concern deals only with one Government representative, and that representative has record of the entire Government production required from the plant.

The study of subcontracts or secondary requirements is fully as important to the general development of the District Mobilization Plan as the study of primary requirements, because upon the ability of the secondary sources to meet their schedules, rests the ability of the prime contractors to deliver completed articles to the fighting forces.

It has been shown how the factory plan resolves itself into facilities and machinery, components and materials, power, transportation, and labor. These subjects will be considered briefly to show the planning required and some of the problems arising in connection therewith.

One of the fundamental considerations in any manufacturing program is the availability of suitable machinery in sufficient quantities. Without this machinery, including of course the dies, jigs, fixtures, small tools and gages, no wheel can turn in the production of material.

Problems of Special Equipment

Many of the machines included in our mobilization plans are of special design, not suited to normal peace time production, but vitally necessary to the Ordnance war program. Some conception of the magnitude of this problem can be gained from the small arms ammunition plan which calls for 226 special lathes from one plant, 180 presses from a second, 186 special machines of miscellaneous types from a third, 172 from a fourth, 143 assembling machines from a fifth, and other quantities from 100 to one or two, from a dozen other sources—a total of 1,296 additional machines, mostly non-commercial, to produce 90,000,000 rifle cartridges a month in one plant.

The necessity for accurate planning is obvious. Some of the machinery involved exists in the form of records, drawings and patterns stored in the machine tool plants.

Much of it exists only in the minds of those who had past war experience.

One plant in this district has made a very interesting study of its ability to handle the allocation and rapid production of about 800 machines. These special machines represent the neck of the bottle so far as quantity production of small arms ammunition in the early stages is concerned. This company has designated a representative who has visited the ammunition producers directly to discuss in detail the requirements of those companies in the special cartridge machinery called for on the subcontract schedules. The district has been notified that a machinery plant in the New York District contemplates the same procedure as soon as more complete requirements are obtained by them. This direct intercourse among manufacturers on the preparedness plans will probably serve more than any other factor in the accurate development of intelligent factory plans, as it will encourage the users of machine tools to specify definite characteristics and purposes for their requirements.

The requirements in new buildings have been turned over to a reserve officer who is plant superintendent of a large corporation in the district and he has obtained, by conferring with several contractors, a complete estimate of time, material, labor and transportation for the construction program, including estimates of shafting, belting and power lines for the installation of all additional machinery.

After the plant has been organized and equipped with the necessary machines, material must be available as required so that full efficiency can be obtained from the equipment. Raw materials must flow into the factory at a rate to keep production at its maximum. Components must arrive in time to be incorporated in the assemblies and packing material must be on hand to receive completed articles ready for shipment.

Planning for Raw Materials

In planning for raw material capacity, an allowance must be made for the requirements of other branches of the service and of the Navy Department which have not been received by this district at the present time and which can only be roughly estimated. Certain capacity must be set aside for necessary commercial production which can be estimated only with difficulty by comparing present commercial output with past war commercial output and reserving an appropriate percentage.

One of the large brass mills in this district has five plants, three of which are located within the district, and two of which are allocated for priority to other branches of the service. The ordnance program, therefore, must consider only three of these plants.

Arrangements were made with the company whereby a given poundage of material was available for consideration without further negotiation. Until this quantity was reached, the district office simply checked off requirements in brass rod and strip against the available balance. As soon as the load on this plant began to be excessive, due to its selection as a preferred source by prime contractors, it became necessary for the District Office to attempt to distribute the requirements by negotiation with other plants and with the prime contractors.

One prime contractor has agreed to transfer some of the requirements from this source to another, nearer at hand. Another prime contractor produces about half of the material required for his war time schedule and a third produces an excess of material over his probable war time needs.

The Boston District prefers its raw material in the form of cups rather than in strip, and this district selected as the source a plant equipped with cupping presses in addition to its rolling mill machinery.

Components must be resolved into terms of material because many of the plants making these components secure their material from the large mills included in the raw material program.

In studying the securing of components and material, an effort should be made to keep well below the maximum capacity of any producer and to allow a sufficient factor of safety for increasing production due to unforeseen circumstances that will arise in the event of war and due to additional requirements that have not been developed but are bound to occur.

One plant in this district has worked out its plan on a ten-hour basis, assuming that in case of war it would work twenty hours per day, thereby including in its estimate a reserve capacity of fifty per cent to allow for the unexpected.

Sources of Power

With the machinery installed and the material on hand the next requirement for production is power. The plans of the district show that at present no shortage of power is probable. The increased activity due to war production will carry with it a decrease in some of the peace-time power requirements and most plants and power stations are equipped to handle a considerable increased demand.

Those plants which will require large quantities of additional power are submitting these estimates so that eventually the problem can be presented to the power companies in each manufacturing center. A power study, however, is of little value until all branches of the service have determined a large per cent of their production requirements. All plans having to do with power must ultimately be presented to the Assistant Secretary of War.

The transportation situation has been estimated roughly for the entire district, and seems to present no critical problem. Truck transportation can be used advantageously within the district and to points in adjoining districts owing to the short distances and the excellence of the main highways.

The Car Service Division of the American Railway Association has been furnished with a schedule of freight cars per month required at each of the large cities in the district. For the first year, they will not exceed one hundred cars per day for the entire district.

The labor problem is one of the most critical in any manufacturing program and probably the most difficult to accurately foresee. Factory plans in this district include statements of total labor required for each prime contract, and in some cases the distribution of this labor into various classes of skilled and unskilled, and the male labor replaceable by female.

It is important, however, that an estimate should be made of the gage and toolmakers required, and of the classes of labor to be exempted from draft.

One plant has contemplated the combination of several factories in different parts of the city under one management, thereby localizing the labor situation as regards housing and street transportation, rather than

a large expansion in one locality with the attendant congestion of labor.

A number of interesting and valuable features have resulted in the Bridgeport District from the detailed development of factory plans. Many of these bear on new methods of production which might be suitable to Ordnance work, and others deal with organization and administration.

A study is being made by one plant of the adaptability of an automatic bulldozing machine using electric heating to the quantity production of armor piercing cores. This machine has operated successfully on brass and aluminum alloys as well as on steel, and may show possibilities for a variety of government work.

One plant is studying the production of a new type of fuse as to the practicability of placing this article on a quantity basis in case of emergency.

This same plant has developed under the guidance of men who had war experience, a group of about twenty-five engineers and executives who would probably be in charge of production in the event of an emergency. This group meets periodically to study Ordnance problems and is being trained to form the nucleus of an Ordnance production organization within the plant which will be familiar with Government methods and material.

It is felt that an organization of this character, properly developed and trained, and kept constantly in touch with Ordnance plans is a most important step toward real industrial preparedness.

Conclusions

It has been said by some that a detailed factory plan is only about 25 per cent efficient, or that most of the information contained therein is of little or no value; that actual emergency conditions will upset most plans

The Bridgeport District feels that a plan is as efficient as the permanent value of the information it contains. A plan that gives all essential requirements and is capable of periodic revision with a minimum of effort is 100 per cent efficient as long as every item contained therein represents a problem which if planned in advance will save time, dollars and lives when war comes, or will assist in the development of a new process, help regulate priorities or serve as a text to train a production organization.

Aluminum Paint—Discussion

By E. Andrews

HAVING had considerable experience with aluminum paint, I should like to add to the points brought out in an abstract on this subject, published on page 247, Vol. 63, of the *American Machinist*.

On account of its high reflectivity, heat resisting, anti-corrosive and highly decorative properties, aluminum paint is proving an efficient material for a variety of purposes in metallurgical, power, and industrial plants. Aluminum paint has a covering or hiding power excelled by no other paint, and is also an excellent protective coating for iron and steel. The objections sometimes raised to the use of aluminum paint on radiators, because of its low emissivity, are not serious, since most of the heating effect in this case results from air-convection currents. No special preparation is necessary beyond removing all rust, dirt and grease from the surface to be painted.

The durability and protective power of aluminum paint is probably due to the complete opacity and high reflectivity of aluminum, which reflects from 65 to 70 per cent of the visible spectrum and, approximately, 90 per cent of the infra-red. Aluminum paint has a great affinity for iron and steel, but in order to obtain the best results, it is particularly desirable for the paint to be applied to the metal surfaces somewhat sparingly. Recent exposure tests on iron and steel panels painted with aluminum paint, show that the paint, when properly made and applied, is capable of protecting iron and steel under relatively severe conditions for about three years, with a satisfactory prospect of longer life.

Aluminum paint is usually supplied at the right consistency to use, but if it requires thinning, then only the special thinning preparation should be added. This preparation is obtainable from most paint dealers, and, unlike turpentine or its substitutes, it does not dull the bright luster of the paint. A satisfactory aluminum paint for a variety of decorative and protective purposes can be made by thoroughly mixing 2½ lb. of what is known as standard varnish-polished, aluminum-bronze powder (as free from grease as possible) with one gallon of spar varnish, thinned with about one pint of mineral spirits so as to give a smoothly spreading paint. In practice it is found that polished aluminum-powder paint does not stain so readily as paint made with unpolished powder, and in consequence gives a smoother sheen.

Not only should aluminum paint be well stirred previous to its application, but it is also necessary to well stir it repeatedly during the painting process; otherwise the fine metallic particles will fall out of suspension and form a deposit at the bottom of the container. One coat of aluminum paint is sometimes sufficient (particularly is this the case when renovating galvanized iron or steel articles, such as, water cisterns, galvanized iron water pipes, corrugated galvanized iron roofing, dust bins, etc.), but two coats, of course, make a better job. In any case, the paint should be applied somewhat sparingly. Two coats are particularly desirable when the paint is required to withstand heat. The paint should also be well brushed about until it is practically dry, the object being to remove all traces of liquid, to obtain a uniform and smooth coating, and to work the bright metallic particles into the iron or steel under treatment.

It has recently been discovered that aluminum paint makes a very good primer for the steel paneling and other parts of automobiles and railroad cars.

In conclusion, it may be mentioned that recent experiments show that a coating of aluminum on iron or steel, will protect these metals from high-temperature oxidation. The life of metals so coated is at least four times as long as that of uncoated metals. The method of application is by means of the process of metallization, whereby it is possible to coat any solid substance with an impervious layer of aluminum, of any thickness from 0.001 in. upward. Since modern methods of metal spraying have been dealt with in the pages of this journal, further reference to the process is unnecessary.

Automotive Production

Willys-Knight Production Methods

By Fred H. Colvin
Editor, *American Machinist*

Some of the problems involved in making thousands of cast-iron sleeves, approximately ⅛ inch thick and 10 inches long, and having uniformly small tolerances

Sleeve Valves

ANOTHER striking difference between the manufacture of poppet and sleeve valve engines, is the making of the sleeves. And it is a real problem to bore, turn, slot, drill and grind cast-iron sleeves approximately 3½ in. in diameter, 9½ in. long and ⅛ in. thick, and keep them within the required limits of diameter, straightness, roundness and concentricity. It requires the right kind of iron, carefully designed holding fixtures, and tools that will cut without undue pressure to cause distortion. Each boring head works on its own series of sleeves, boring as many sleeves at once as there are bars in the head. The sleeves are held in place by the inner chains bearing against the arms as at *A*, that in turn bear on *B*, as can be seen at *C* in Fig. 1. The double clamping arms make it easy to load and unload the sleeves from the other side of the machine. The clamps hold the sleeves in position, but they are prevented from turning by the lugs bearing against the stops, as at *D*, the lugs, or ears, forming the bearing for the sleeve-rod that moves the sleeve valve when the engine is in operation. The boring bars are fed into the work by a large cam at each end and the boring is done at the rate of about 6 in. per minute.

The rough turning is done on the Bullard Contin-u-matics, Fig. 2. Some of the various operations on these machines, as well as the tooling for turning and facing both the upper ends and the ears, can be plainly seen. The turning toolholders swing open to permit the easy loading and unloading of the sleeves.

The sleeves are then heat treated to relieve internal stresses after the skin has been removed from both insides and outsides, after which a second, or semi-finishing cut it taken on the outsides, also on the Contin-u-matic, and the insides have their first reaming on a 4-spindle Foote-Burt machine, as in Fig. 3. The sleeves are held in solid fixtures having four holes in which they fit easily. The thrust of the reamer is taken by the ears against the pins shown. The fixtures are mounted on V's and are pulled forward for unloading and loading, ample handling facilities being provided at both top and bottom. The fixtures are correctly positioned by the two locating pins in front, and the table is counterweighted.

The openings for the sleeve rods are milled on the Ohio tilted rotary milling machine in Fig. 4, fitted with a very simple and efficient clamping device that makes handling easy and rapid. The ears on the sleeves are paired in rights and lefts as at *A* and *B*. With the sleeves properly centered and located, the lower ears rest on small screw jacks, and, as the table brings the work in front of the cutters, the roller *C* goes under the plate *D* and holds the ears right over the cutting point, while the milling cutters feed into both pairs of ears at the same time. The use of interlocking cutters enables the width of the slot to be maintained within the desired limits.

Then the bottoms of the sleeves are chamfered, spiral oil grooves milled and oil holes drilled, one of the four-way machines used being shown in Fig. 5 with a sleeve in place. Each set of three drills feeds simultaneously, and the production rate is high. There is also a horizontal machine in which the sleeves stand vertically while being drilled. The next operations are: finish reaming, finish turning and grooving, and a final facing and chamfering, after which the outsides are rough ground as in Fig. 6. The sleeves are well supported on mandrels and driven by the ears, other mandrels being loaded while the grinding cut is under way.

The ears are then drilled and reamed for the pins by which the sleeves are driven, the two machines in Fig. 7 being grouped for this operation, the sleeves coming to the operator on roller conveyors. The holes are drilled automatically in a double-spindle machine at the right, the sleeves being held over stub mandrels by a C-washer and hand nut. The holes are reamed in the small, hand-feed machine at the left. The ears are held between blocks that guide the reamer and insure correct alignment.

The ports are milled in a special Foote-Burt machine, Fig. 8. A small end movement of the table allows the ports to be cut in all the sleeves at once. The thin walls of these sleeves make it necessary to take every precaution against distortion, both in clamping and in machining, so that the ends of the sleeves nearest the

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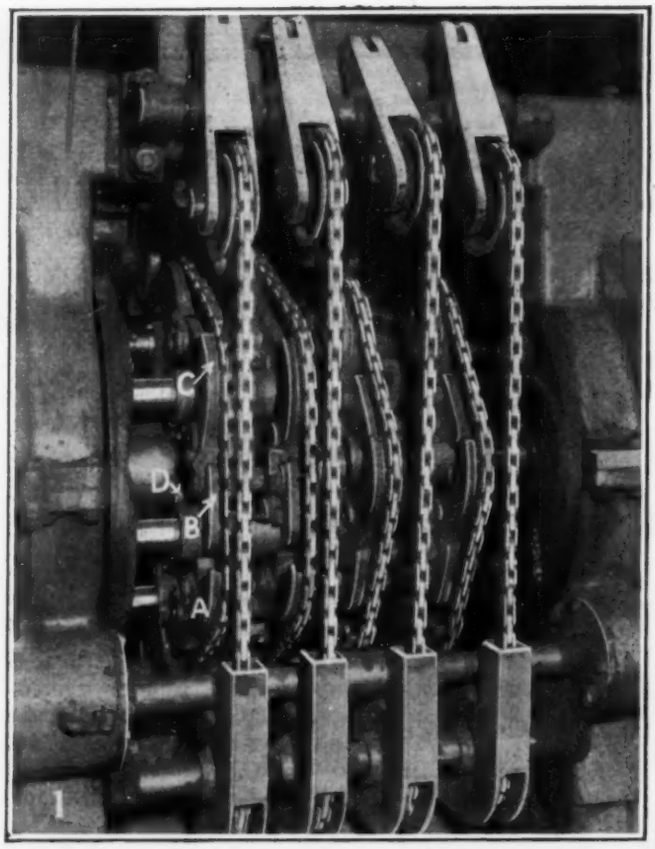

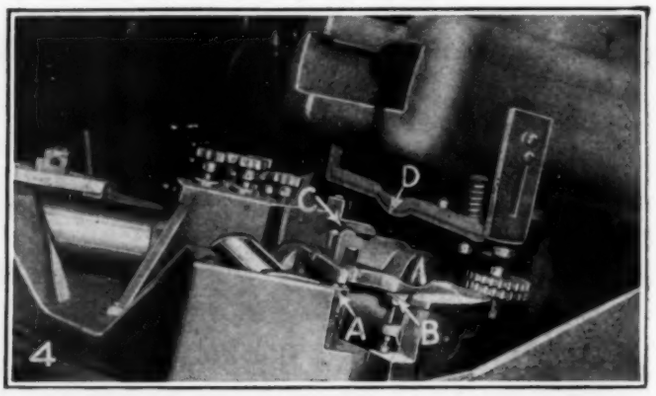

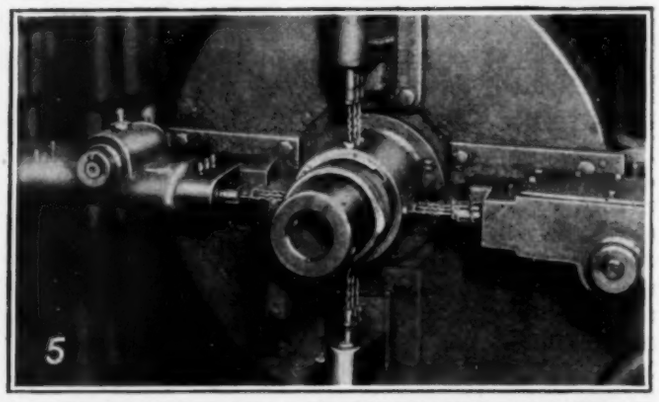

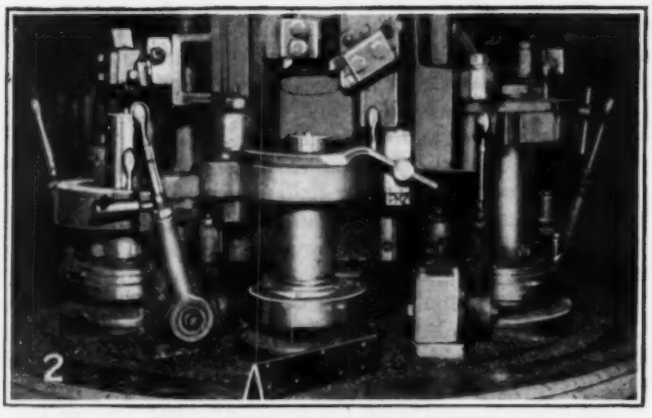

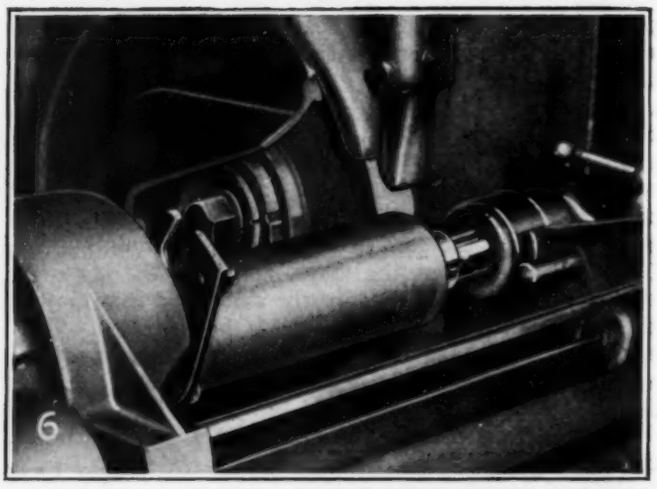

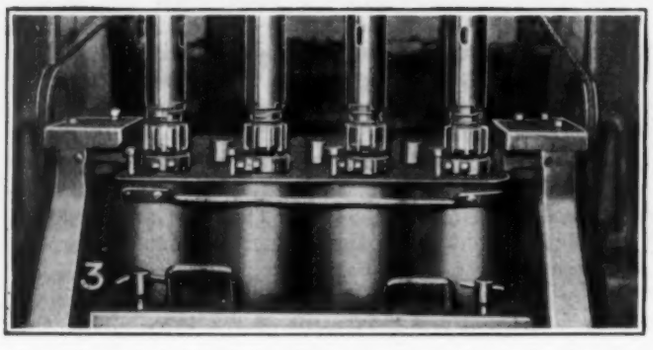

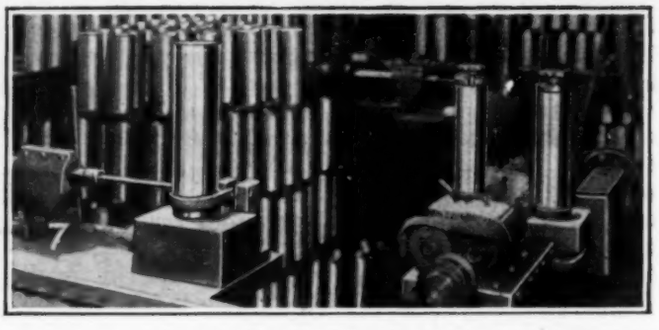

Fig. 1—Rough boring the sleeve valves. Fig. 2—Turning on the Contin-u-matic. Fig. 3—Reaming four sleeves at once. Fig. 4—Milling ears for sleeve rods. Fig. 5—Drilling twelve oil holes at once Fig. 6—Rough grinding on a Norton machine. Fig. 7—Drilling and reaming ears

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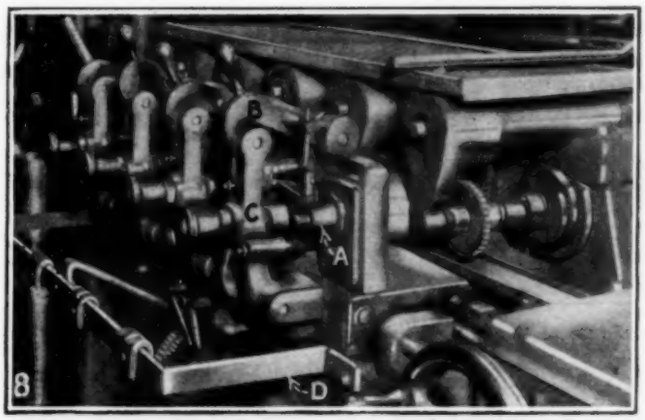

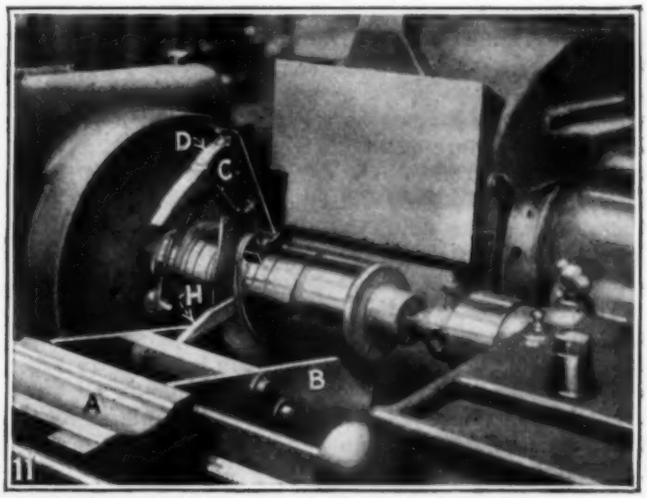

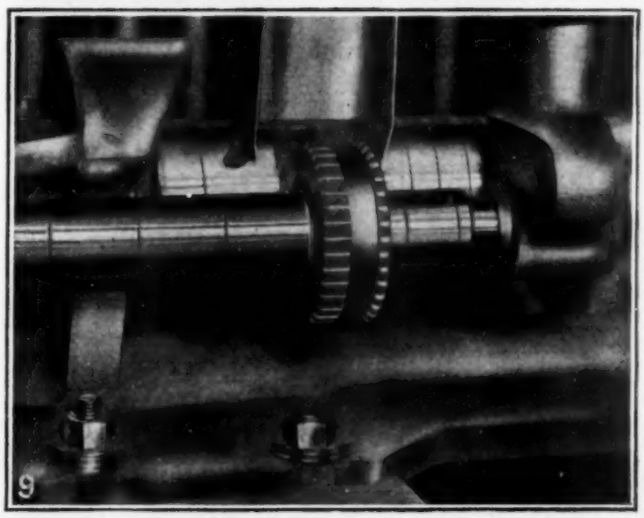

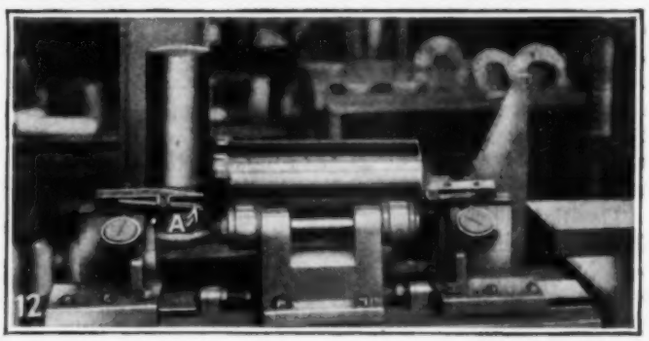

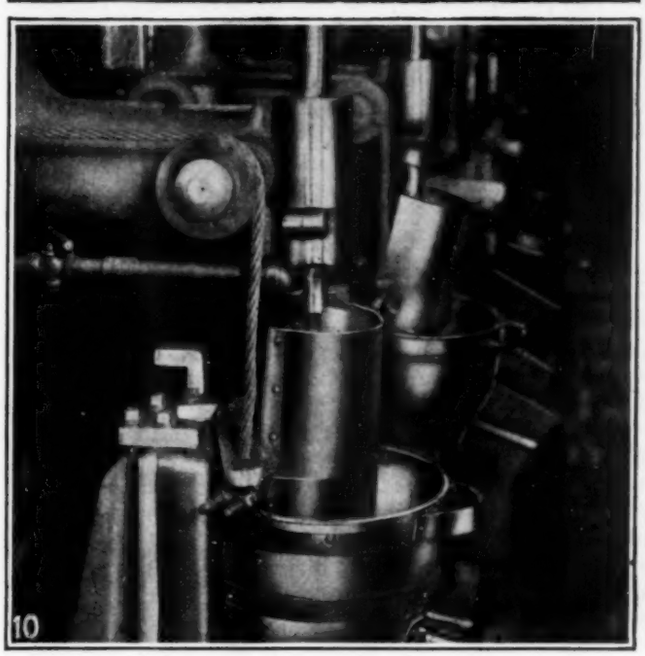

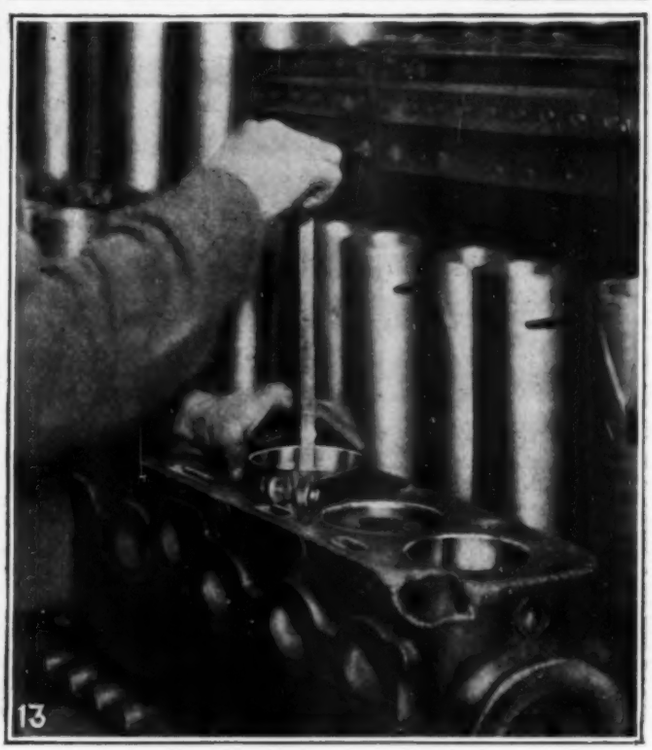

Fig. 8—Milling the ports. Fig. 9—Cutting corrugations on exhaust side. Fig. 10—Lapping the sleeve bores Fig. 11—Finish grinding with full width wheel. Fig. 12—Fixture for testing concentricity Fig. 13—Testing bore with sleeve in block

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cutters must be well supported. The ports are located by having the ears fit over suitable blocks *A*, and pins through both ears and the blocks hold the sleeves in position. An end pressure against the sleeves is provided by the clamps at the front, the latches *B* holding the three pressure points of the forks *C* against the sleeves during the milling of the ports. Upon lifting the latches *B*, the forks *C* drop out of the way and allow the sleeves to be easily withdrawn. The supports *D* keep the forks from dropping farther than necessary, a pad being provided for each fork.

The small slots are then milled for the oil rectifying system, after which the corrugations each side of the exhaust ports of the outer sleeves, are milled as in Fig. 9. These small grooves assist in keeping an oil seal around the exhaust ports and seem to be common practice in sleeve-valve engine building. The sleeves are next lapped singly in the battery of improvised machines shown in Fig. 10, the laps, or hones, traveling through the bores at the same time they revolve, as with the cylinders. The guards shown keep the kerosene and abrasive from flying over the room. The sleeve holders are lowered to insert new pieces of work, the counterweights making them easy to handle. As with the cylinders, the lapping does little more than remove the "fuzz" left by the grinding operation.

The finish grinding is done without traverse, on a Cincinnati plunge-cut machine, as in Fig. 11. The wheel has a 10-in. face and, except for the slight oscillatory end motion, feeds straight into the work. The sleeves are mounted on mandrels, as before, and a loaded mandrel rests in the block *A* while another sleeve is being ground. When the ground sleeve is removed from the centers, the new sleeve can easily be rolled down the inclined ways *B*, leaving it but a trifle below center, so that the cone points on the centers raise the sleeve off the ways. In this way the work clears the ways and obviates the necessity of having swinging ways, as is the usual practice.

Fig. 14—Measuring diameter at four points

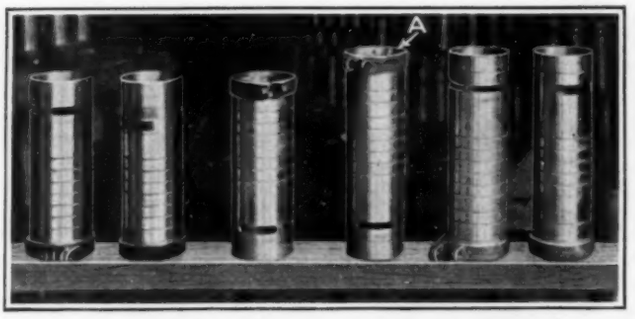

Fig. 15—Finished sleeves of both kinds

The sleeve diameters are measured while being ground, by the Arnold gage shown at *C* in Fig. 11. To reduce wear to a minimum, large contact shoes, easily adjusted, are provided. The pointer at *D* shows the diameter of the work at all times. To remove or put sleeves into place, the upper shoe is lifted by a latch. The projection of the frame *H* rests on the cross-bar of the ways and holds the gage on the work.

After a slight milling operation the pin holes in the ears are finish reamed, any necessary burring is done and the sleeves are washed ready for final inspection. There have, however, been inspections between operations, as for example, the test for concentricity after the turning operations, in the fixture shown in Fig. 12. Here the sleeve rests on four rollers and the indicating gages at the ends show any eccentricity as the sleeve is turned on the rollers. The gage at the left is withdrawn to show its construction. The lever *A* has a ball at the end that contacts with the inside of the sleeve, and any variation is indicated on the dial gage. The other gages test the bore and the location of the oil grooves.

One of the midway inspections is shown in Fig. 13 where the sleeves are lowered into a cylinder block while the inner diameters are being gaged. This inspection is to show how much, if any, the sleeves change by being put in a cylinder block and helps to show the extreme care that is used in maintaining the desired accuracy at all points.

Another inspection, after all the machining has been done, is shown in Fig. 14. The sleeve rests in a V-block, and, as it is revolved by the inspector, the dial gages show any variation from roundness. The tolerance is 0.0005 in. out of round and the same amount for taper, while the diameter is held to a tolerance of 0.001 in. The inspecting of these thin sleeves is a somewhat delicate operation, since they must be handled carefully. The metal is a very dense iron that retains its shape well in spite of the thin wall. And if, as occasionally happens, a sleeve should exceed the out-of-round tolerance, a gentle tap from a wooden mallet usually restores it to shape, which it retains.

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The gage in Fig. 14 tests the sleeves at four points along their length.

A few finished sleeves are shown in Fig. 15, in which the long, inner sleeves are at the right and the outer sleeves at the left. The inner sleeves have shallow clearance grooves for the connecting rods milled at *A*, as can be seen in the left inner sleeve. The necessity for these grooves shows the compactness of the engine.

Automobiles and Machine Tools in France

By an American Observer

THE machine tool business in France during the year just finished continued, as in previous years, to be seriously affected by the depreciation of the franc, although a marked improvement in the importations from the United States was noticeable up to the time of the further recent drop in exchange to 27 francs of the dollar. The principal lines benefited by the improvement were gear cutting machines, gear grinding machines, automatics, milling machines and grinding machines.

With the franc at its present low level it is very doubtful whether this improvement can be maintained, as American machine tools, figured on the basis of exchange rates now prevailing, are beyond the reach of most machinery buyers whose working capital is insufficient to permit them to invest such large sums in plant equipment in spite of the attractiveness of the lower labor costs that such machines offer.

Financial Fluctuation

Even this handicap might, however, be overcome if some sort of stability could be brought about in the exchange rate, since it is rather the violent fluctuations in the value of French currency than its depreciation that make it impossible for French business men to look forward and to plan their financial, manufacturing and selling programs over the period necessary to put into effect a harmonius business policy.

A great amount of effort was put forth during the year by agents for American machines to introduce into France the new high-production machine tools that have been developed in the United States since the war. In the majority of cases these efforts have been unsuccessful, not because French plants have not appreciated the advantages of the new machines but, in the first place, because of the high franc prices of the machines and, secondly, on account of the fact that few French factories have sufficient production to keep machines running steadily on a single piece. This necessitates frequent tearing down and retooling, factors which have usually acted as a deterrent to sales. It is doubtful, however, whether French factories, particularly the automobile factories, will be able to put off for very long the adoption of new high-production American machines, since in seeking to expand their export business they will ultimately feel very keenly the competition of American, British and Italian automobile builders whose labor-saving machinery is already an important offset to present low French labor costs. How important the export field has become for French builders is evidenced by the fact that one of the largest French plants during the past year exported half its output.

This competition is even now marked in the steadily growing importations of American automobiles into France. Whereas a year or two ago an American automobile, apart from the Ford and a few of the other makes left over from the war stocks, was a rarity on French roads, today Buick, Chrysler and Packard cars are becoming common in the streets of Paris and this notwithstanding an ad valorem customs duty and luxury tax of 60 per cent on the landed cost in France of imported cars. French motorists who, a year ago, would not have thought of buying anything but one of the classic makes of home products have gone over enthusiastically to six-cylinder American cars, while American body work which was once classed as distinctly inferior to hand-made French bodies is now admitted by unbiased experts to be superior.

French Roads Deteriorated

Automobile builders who have looked on at the invasion predict that bad French roads will quickly wear out the American invaders and that the public will come back disillusioned to the home product. In this connection, it is interesting to remember that not so many years ago American automobiles were looked upon as too heavy and rough for the superior French roads, while now the reverse is claimed for them, American roads having meanwhile improved while French roads, due to the lack of upkeep during the war, have greatly deteriorated. These predictions aside, to the casual observer it is apparent that the American automobile has come to France to stay and that French builders will have to look to their laurels if they are to arrest the growth of the invasion not alone in France but in the markets which have been newly opened to the French for the export of their cars.

This, in the minds of competent American engineers who have visited French factories, can only be accomplished by bringing their equipment up, as some of the Italian builders have done, to the standards set by the successful American factories, which means a heavy initial expense but at the same time a substantial reduction in machining costs, with an accompanying improvement in the labor situation.

The tendency of French factories to be prodigal in the use of labor through the practice of doing many single operations on engine lathes and hand turret lathes that could be handled more efficiently on modern machines is having the effect of seriously complicating manufacturing through the scarcity of labor, there being practically no unemployment in the metal-working centers and the tendency to lack of interest in their work on the part of the men becoming increasingly great. From all appearances, the day is fast approaching when the labor problem, especially in the congested district of Paris, where most of the automobile factories are located, will necessitate the adoption of the organization methods and the modern production ma-

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chinery that have made the United States so much more successful in manufacturing than the rest of the world. Just now, manufacturers in the Paris district are worrying over the coming to Paris of the new Ford assembly plant which will, it is said, take approximately 900 men from a supply already taxed by the demand and will pay in excess of the rates usually paid for similar labor.

It would therefore seem as if general economic necessities were conspiring to bring the French market back into the fold as a substantial purchaser of American machine tools.

The industrial crisis in Germany has to a certain extent stimulated French purchases of machine tools in that country. German manufacturers are reported to be making many sacrifices in order to make sales in France and some orders are being placed. This is probably only a temporary situation, however, as German manufacturers in the face of practically non-existing bank credits and constantly mounting production costs, cannot long continue to offer machines at what must be greatly below the cost of manufacture. One German factory is reported to be selling all-geared-head turret lathes with 2-in. spindle capacity for slightly less than $800, French duty and railway charges paid.

Latest Models Wanted

The demand for second-hand machines continues fairly active, although the surplus stocks left over from war industries have been almost liquidated and good used machines are scarce. A considerable number of used machines have in recent months been shipped to Poland and Italy, the equipment of one notable auto truck factory comprising six hundred machines having been bought outright by the Polish Government. Buyers, however, still keenly canvass the second-hand machinery market before placing orders and, in the majority of cases, give preference to used machines on account of the wide difference in price. At the same time there is noticeable a tendency on the part of some of the more progressive shops to realize that first cost should not be the determining factor in the purchase of machines and works managers and foremen responsible for production are beginning to ask for the latest model machines.

American manufacturers, therefore, who are sufficiently far-sighted to continue the missionary work they have been doing for the past year or more will ultimately realize on their investment while those who have been easily discouraged will find themselves handicapped when the tide turns.

It is stated by one who is in the business that there is likely to be a demand for 3,000 internal-combustion-engine rail cars before the end of 1926. This is a field that is growing faster than many realize. These motor rail cars are being used on branch lines where locomotives cannot be run economically and some of them are running over 300 miles a day. It is just possible that the internal combustion engine, that has helped the automobile and motor bus to take trade away from the railways, may help them get it back again.

Abstracts

from other publications

A Drilling Fixture

A multiple fixture for use on a two-spindle machine as used in British practice is described. Four 1¼-in. holes have to be drilled and reamed in a differential housing. Three indexing fixtures were made and mounted on a rotating table. The table itself has a simple form of lifting arrangement by which its weight is taken on a ball thrust washer during the indexing thereby allowing the table to be revolved by means of a light touch.

The fixture is such that at the first station one housing is being drilled by one of the spindles of the machine and at the second station the second spindle of the machine is reaming a housing while at the third station the fixture is being unloaded and loaded.—*The Automobile Engineer* (England), December, 1925, p. 459.

Modern Body Plant

The Edward G. Budd Manufacturing Co. built a plant in Detroit devoted to the assembly, painting and upholstery of Dodge bodies, in only 101 days. The plant was started on Aug. 29, 1925, and on Dec. 9, was completed. The building is 725x100 ft., four stories high, and contains 290,000 sq.ft. of floor space. Body sections such as tonneau backs, top shrouds and cowls are manufactured in Philadelphia at the main plant and are nested and shipped to the Detroit plant in the black. A steel body in its entirety can be completed from stamping room to finished product in 45 min. and the upholstery and painting adds a day.

In the production of the Budd body there are three general processes: first, necessarily comes the designing of the structure complete in all its various details; the next step is the making of the dies and jigs; the third step, which is in reality three operations, is the production of the stampings, the assembly of the parts in the jigs and the welding.

The most impressive part of the new plant is the stamping division with its battery of high Toledo presses. Some of the stampings are blanked out with dies before being formed, but some of the larger sections are cut to the proper shape by rotary cutters or shears. Some of the presses are equipped with dies that perform two or more operations on a stamping at one stroke of the press. The presses are arranged so that line production is possible. Stampings are turned out by the main presses and small presses are moved into the spaces between the main ones, for the minor operations. As the stampings come out of the presses they are placed in a jig where they are firmly held in place and welded, thus a so-called unit is formed and made ready for the final assembly jig.

Spot welding has replaced riveting almost entirely. The Budd company has developed a process which eliminates the low spots ordinarily caused by spot welding. —*Automobile Topics*, Jan. 16, p. 1016.

Modern Tooling Methods for Turret Lathes

By M. E. Lange
Production Engineer, The Warner & Swasey Co.

Tooling for small lots and quantity production —Comparison of costs—Reducing tool cost and set-up time—Universal equipment for bar work

THE method here described for making the feed worm shown in Fig. 31 is suitable for small lot production, using regular forged cutters. The 2¼-in. ram-type machine, Fig. 33, is selected for this work. For combining the forming and chamfering operation, a cross-slide cutter block is mounted on the front of the plain cross-slide, as in the illustration.

While the hole is drilled, recessed, bored and reamed from the hexagon turret, the outside diameter is formed by the cutter block. Two simple cutters made from a square bar are employed, and are ground in the usual way to keep the tool and set-up cost low.

The slide tool, shown in turret position IV in Fig. 32, recesses the hole after drilling. Another slide tool in position VII, chamfers and necks the recesses at (1) and (2). The necking cutter is easily ground by the operator from a cutter previously used on other work. A soft-steel gage locates the second groove accurately.

The vertical-slide tools are very rigid and are used for heavy cuts and work of large diameters. The micrometer dial gives quick adjustment to size, and allows accurate stopping of recessing cuts. The hole is finish bored with a forged boring cutter held in turret position V. All the cutters may be used again on other work, so that the tool charge for small-lot production is kept very low.

The front, cross-slide cutter block shown in Fig. 34, replaces the usual toolpost and will hold simple bits or forged cutters for multiple cutting, from the front or rear of the cross-slide. Its use eliminates expensive, single-purpose, multiple-cutter blocks.

The tooling layout for making large quantities of the feed worms is shown in Fig. 35. A special, dovetail forming cutter, held in an ordinary forming-cutter holder, is mounted on the rear of the cross-slide, as shown in Fig. 36. The dovetail cutter is machined from soft steel to the shape wanted, and then hardened. The straight diameter is formed, necked and chamfered with the one cutter. For sharpening, the cutter is ground on the top only, thus the shape is not changed and the work produced is kept uniform.

Both the facing and cutting-off cutters are mounted on the front of the cross-slide in the same cutter block shown in Fig. 34, but with tools arranged as in Fig. 3. The vertical-slide tool in position VI of the hexagon turret, however, now forms the recess at the back end, instead of necking and chamfering the formed diameter. With this exception the layout for the hexagon turret is the same as the previous method.

> Not so long ago the turret lathe was considered solely as a production machine and was rarely used for work in lots of less than several hundred. Now, due to changes in the machine itself and in the methods of tooling, work in lots of less than one hundred can, in a great many instances, be economically produced

The savings made by a special forming cutter of this kind must, of course, at least more than pay for the cutter in the quantity produced. Although the cost methods for each shop may vary, let us assume an average basis and arrive at a cost comparison.

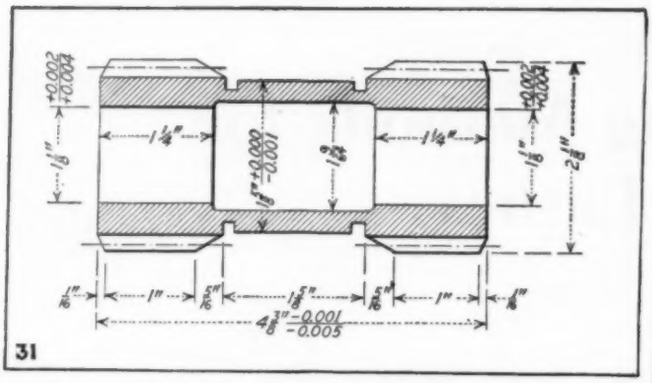
If it takes fifteen hours to make this cutter, at the rate of $1.50, the cost is $22.50. Comparing this cost with the cost of the forged bits previously used, $0.50 (or 20 minutes), there is an increased tool cost of $22 for the quantity method. Now let us consider the saving per piece, as shown by the accompanying table.

Costs Compared When Using Tools Adapted to Small Lots Against Tools Adapted to Quantity Production

	Flat Time per Piece in Min.	Prod. Time per Piece in Min.	Cost per Piece
Small Lot Method....	12.10	15.1	$0.377
Quantity Method	10.50	13.2	$0.33
Saving per piece.....			$0.047

It is evident, then, that since the tool cost is $22, and the saving per piece is $0.047, the extra tool cost will be absorbed by $\frac{\$22 \text{ (additional tool cost)}}{\$0.047 \text{ (saving per piece)}}$ or 468 pieces made. Hence, this quantity-lot method is justified only when at least 468 pieces are made in the lot.

The third article. The fourth will appear in an early issue.



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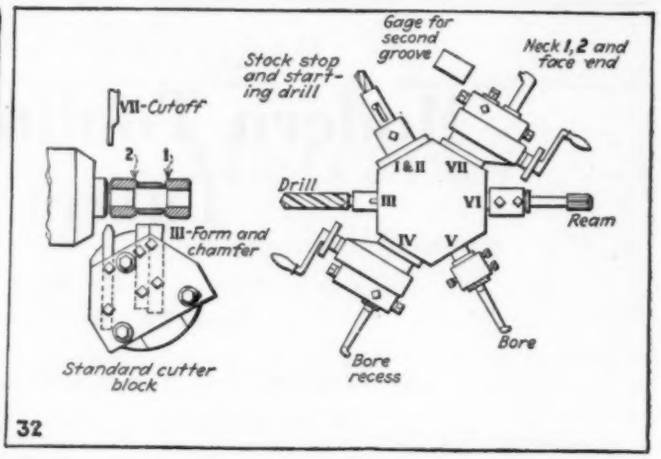

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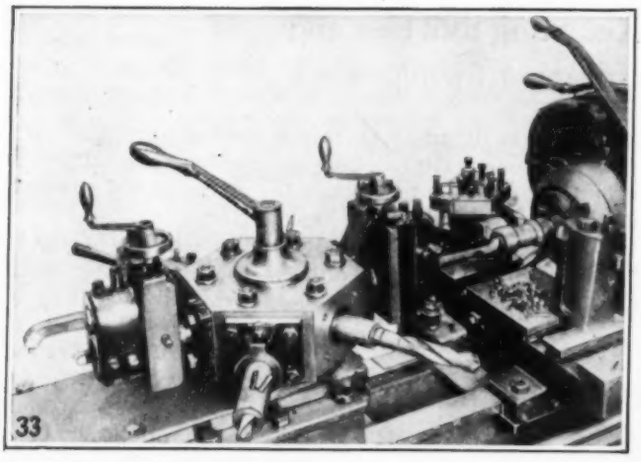
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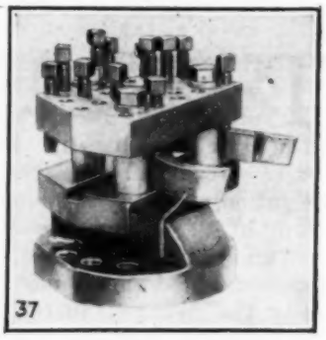
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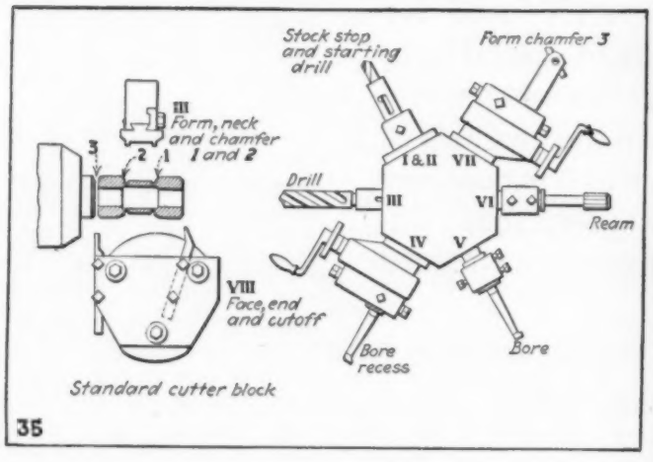

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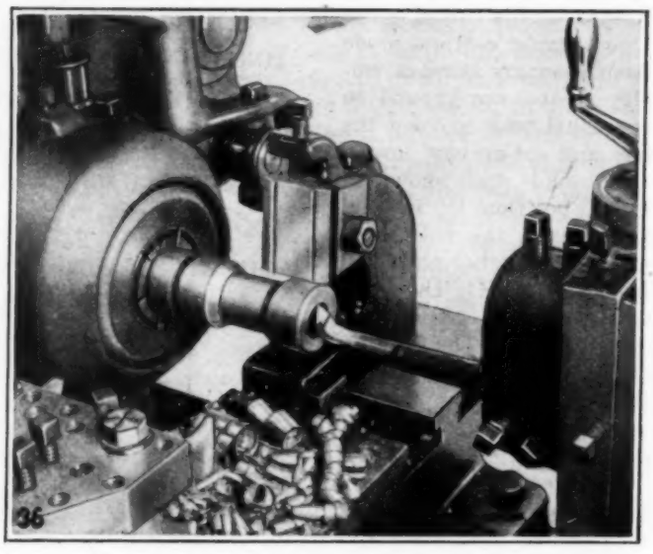
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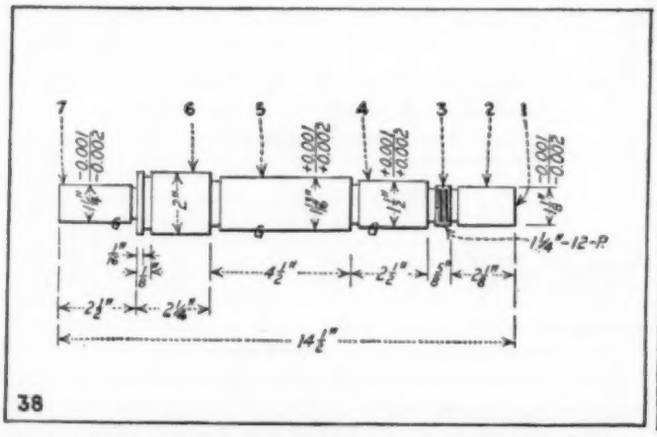

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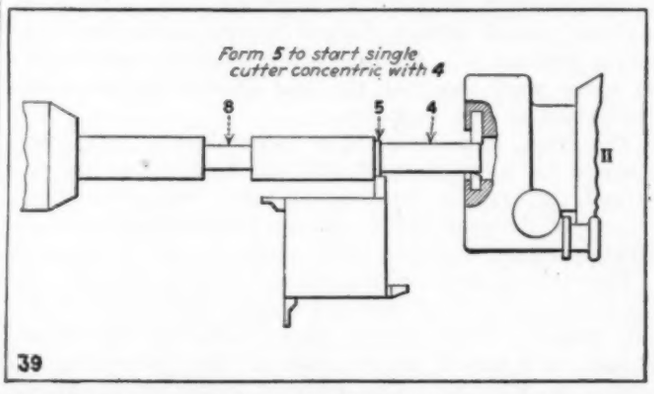

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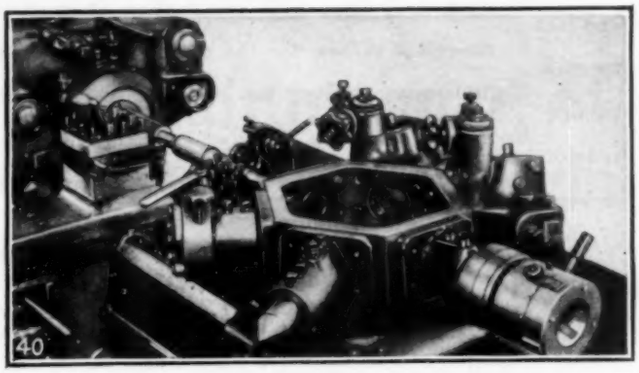
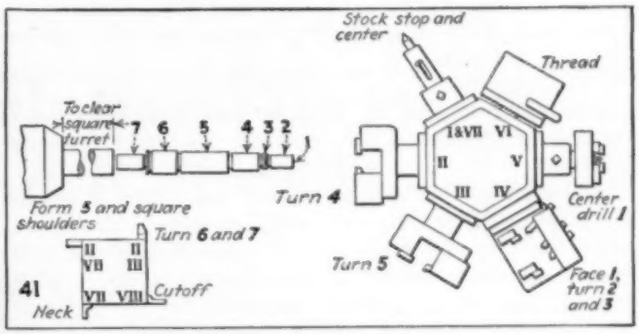
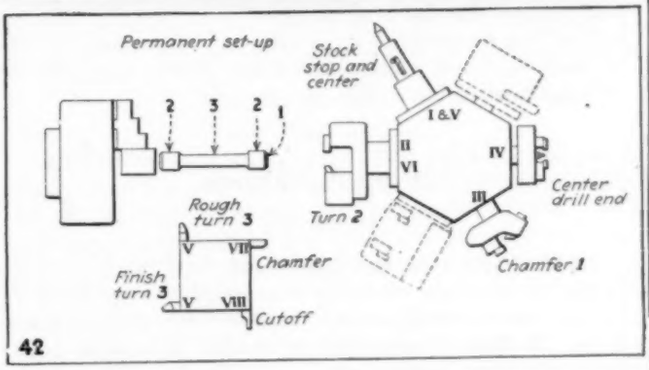
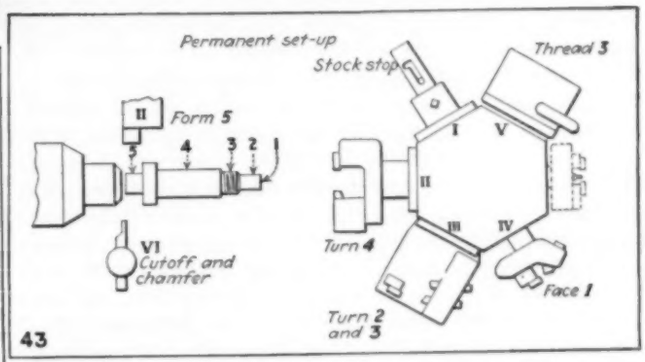
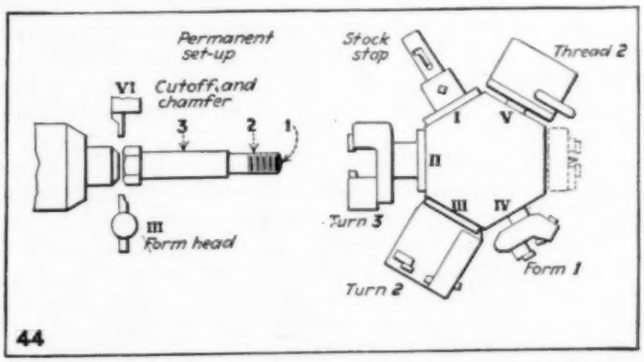
Fig. 31—Feed worm. Fig. 32—Tooling layout for small lots. Fig. 33—Machine tooled for feed worm. Fig. 34—Cross-slide cutter block. Fig. 35—Tooling layout for quantity lots. Fig. 36—Dovetailed forming cutter Fig. 37—Cross-slide cutter block. Fig. 38—Cold-rolled gear shaft Fig. 39—Method of turning gear shaft

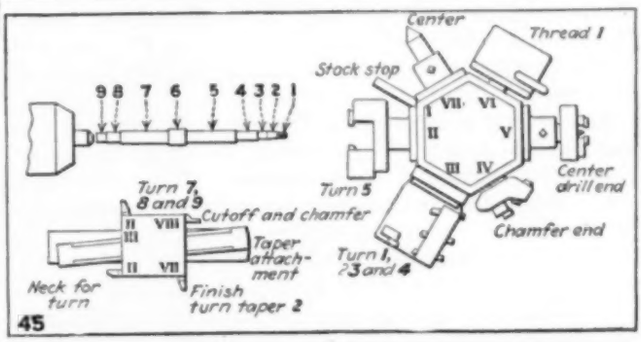


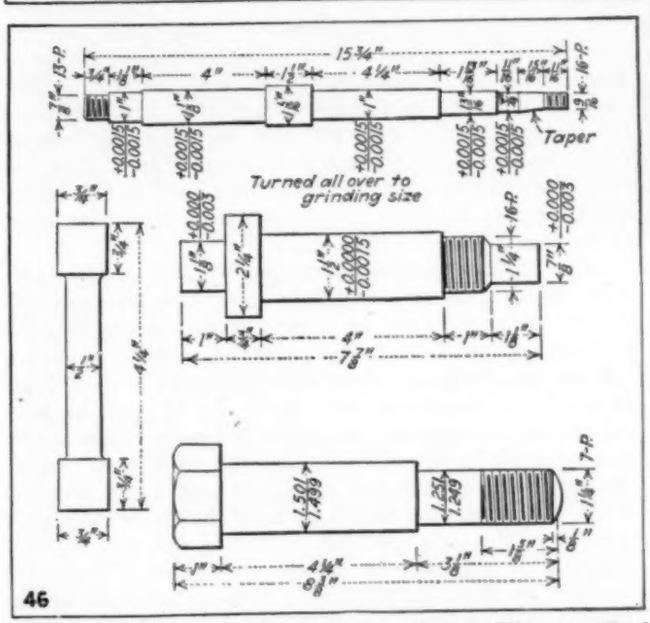


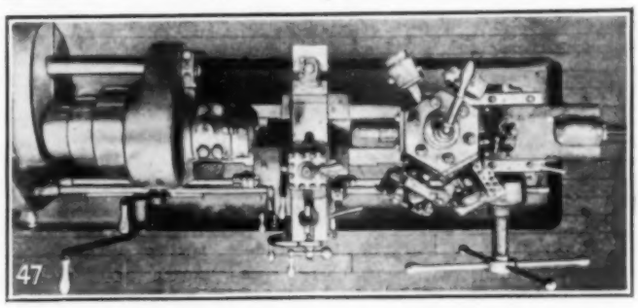












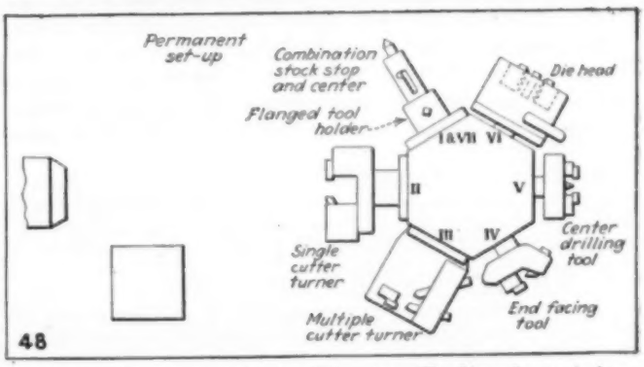


Fig. 40—Machine tooled for gear shaft. Fig. 41—Tooling layout for gear shaft. Fig. 42—Tooling layout for test bar. Fig. 43—Tooling layout for idler spindle. Fig. 44—Tooling layout for hexagon-head bolt Fig. 45—Tooling layout for armature shaft. Fig. 46—Test bar, idler spindle, hexagon-head bolt and armature shaft. Fig. 47—Permanent arrangement of universal bar equipment. Fig. 48—Permanent set-up for universal bar equipment

The diameters (2), (4), (5) and (7) of the cold-rolled gear shaft shown in Fig. 38, are not only held to limits of $\begin{matrix}+0.0000\\-0.0002\end{matrix}$ over the grinding allowance, but they must also be concentric. Fig. 39 shows the method of turning of diameter (5), and the tooling is therein indicated.

A cutter in the square turret first forms ¼ in. of the length of diameter (5), while diameter (4), which has already been turned, is still supported by the rolls of the universal turner on the hexagon turret. This forming operation assures concentricity of diameter (5) with the diameters already finished, and avoids the necessity of turning diameter (5) its entire length of 9¾ in., before starting the turning of diameter (4). This method substantially reduces the cutting time.

To make this gear shaft requires a 2¼-in. sliding-saddle type of machine, Fig. 40, because a greater turret travel is needed for the length of the piece (14½ in.) than can be had in a machine of the ram type. The tooling equipment, Fig. 41, is similar in principle to the smaller machines. A multiple-cutter turner, usually used on the ram type, is mounted on the turret with an adapter plate for average lot production. If only five to six pieces were being made, the turning cuts on diameters (2) and (3), and the end facing cut on diameter (1), would be taken from the square turret to reduce the set-up time. In that case the free end would be supported by the center while turning these diameters.

The tooling equipment in Fig. 42 is for making test bars, as at *A*, Fig. 46, in small lots, from irregular, rough test strips of steel castings. Note the 3-jaw chuck suggested for small-lot production to reduce the set-up time.

The tooling equipment in Fig. 43 is for the production of idler shafts, as at *B*, Fig. 46, in average lots.

A 2¼-in. ram-type of machine with plain cross-slide is used, since necking and cutting off only are required from the cross-slide. Note the multiple cuts from turret position III.

The permanent set-up in Fig. 44 is used on a 2¼-in. ram-type machine with plain cross-slide, for making typical bolts, as at *C*, Fig. 46. Multiple cuts are not used in position III because of the close limits of the diameters.

On the armature shaft shown at *D*, Fig. 46, the turning length of 15¾ in. requires a sliding-saddle-type machine with universal carriage. The tools, as indicated in Fig. 45, include a multiple cutter turner of the 2¼-in. ram-type machine, fitted with an adapter plate.

The real problem in turret-lathe tooling is not only to increase production, but to do so without elaborate or special equipment, and without high set-up time.

The way to reduce the tool and set-up cost is to use:

1. Universal tool equipment.

A standard set of "universal" tools for bar work, each tool designed for a given operation such as turning, etc., and adjustable for the cutting range of the machine.

2. A permanent set-up of this equipment.

A permanent arrangement of the tool equipment in the usual order of use. This avoids changing or remounting the standard tools.

Universal Bar Equipment

Such a set of universal tools to handle the majority of bar operations will consist of:

Flanged toolholder, with combination stock stop and center.

Single-cutter turner, for the bulk of the straight turning.

Multiple-cutter turner, for gang cuts or straight turning.

End facing tool, for rounding or chamfering the ends of bars.

Center drilling tool, for accurately centering end of bar.

Diehead, for threading.

The permanent arrangement of the universal bar equipment, in the usual order of use, is shown in Fig. 47. It is kept intact for different jobs, and the only changes necessary from one job to another consist in changing simple and inexpensive forged cutters or bits, and setting the machine stops.

The tool layout in Fig. 48 shows the permanent set-up with each tool named, and gives clearly the order of arrangement around the turret.

Shop Vacations

By Entropy

Some of the men who advertised their machine tools in the early issues of the *American Machinist* must be turning in their graves at the mere mention of vacations. In fact, I remember some that I think must be revolving many times per second. My first eleven years in the machine tool business netted me one ten-day vacation, at my own expense. It did not even make up for the legal holidays that the shop had run and I had worked—and this was in the days of the sixty-hour week.

But disregarding habits of thought, why not have regular vacations for shop employees? Why do office people need vacations more or appreciate them more? The answer is, they don't! As near as I can guess, vacations for office people come from two reasons; one, because the employer is so ashamed of the small wage he gives most of them that he doles out the vacations as a sort of sop to his conscience, to square himself with the hereafter, so-to-speak; the other, because the labor turnover in an office is almost always only a fraction of that in the shop, and the employer shares some part of his gain from this fact with his helpers. Of course, there is also the fact that the big boss is more nearly on equal terms of acquaintance with his office force than with the shop men, and, being somewhat human, he feels obliged to treat them somewhat after the fashion of humans.

Now, if the labor turnover is low, and if the G.M. gets out into the shop and finds that these men in overalls drive pretty good cars, play a fair game of golf, and are educated, and that in other respects they are not so far different from him, perhaps he will offer them stated vacations with pay. To be sure he may safeguard the vacation period by the same means as he has adopted in the office by making each man "earn" his leave at so much per month of continuous employment. That method is only natural, but if he does give vacations, the odds are that, if he has any way of finding out, it will pay in dollars and cents. There are few things more disheartening than to see your neighbors returning from vacations all browned up, happy, though tired, and to realize that the only way that you can do the same is by sacrificing two weeks' pay, beside what the trip costs you.

Maintenance of Motive Power on New England Railroads

By Ellsworth Sheldon
New England Editor, *American Machinist*

Machining new cylinders — Boring and turning cylinder bushings — Cylinders repaired by welding — Pistons and piston rods—"Barometer" for indicating the shop program

ABOUT the most unwieldy part of a locomotive to machine is the cylinder casting, which includes in many cases the valve chamber and in all cases the steam passages to and from the cylinder and one-half the saddle upon which the front end of the boiler of the locomotive rests. Because of their great size, and the fact that all machined surfaces must be parallel in both planes, planers of more than ordinary capacity

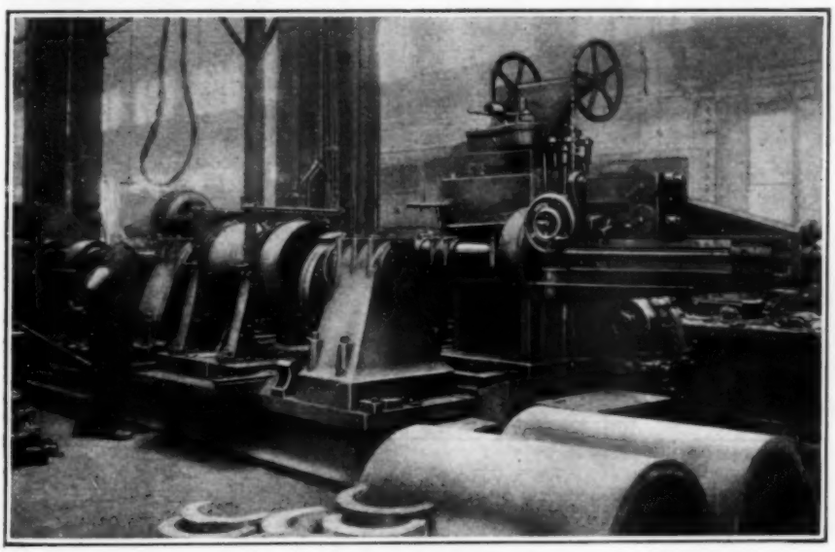


Fig. 1—Boring a new cylinder casting

are required, and special boring mills are a virtual necessity in order to produce accurate results in a reasonable length of time.

Out of more than 1,100 steam locomotives owned by the New Haven road it is not at all surprising that there is to be found among the 30 to 35 engines that pass through the Readville shops every month, one or more that must be provided with new cylinders, and the equipment of the shop includes modern machinery to handle the job.

In Fig. 1 may be seen the Barrett boring machine upon which cylinders, bushings and similar parts are bored and faced. When this machine is operating upon a cylinder casting, the setup is such that all boring and facing operations upon the cylinder and valve chamber may be accomplished without moving the casting, thus insuring accurate alignment. The work upon which the machine is here engaged is the boring of a cylinder bushing, the work being held by suitable clamps. When boring a cylinder, there is a special fixture to hold the casting.

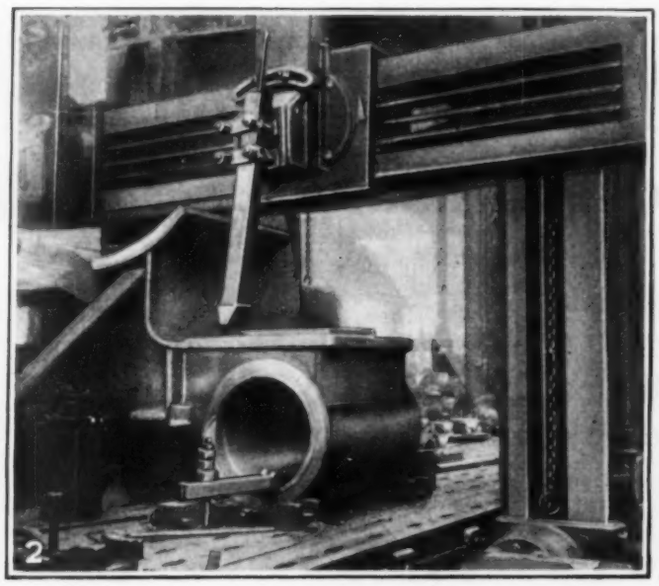
This machine and the large planer shown in the succeeding illustrations are located in the bay adjoining the erecting floor and are under a main runway so that they are served by the large cranes. Independent electric motors supply power to all movements of both machines.

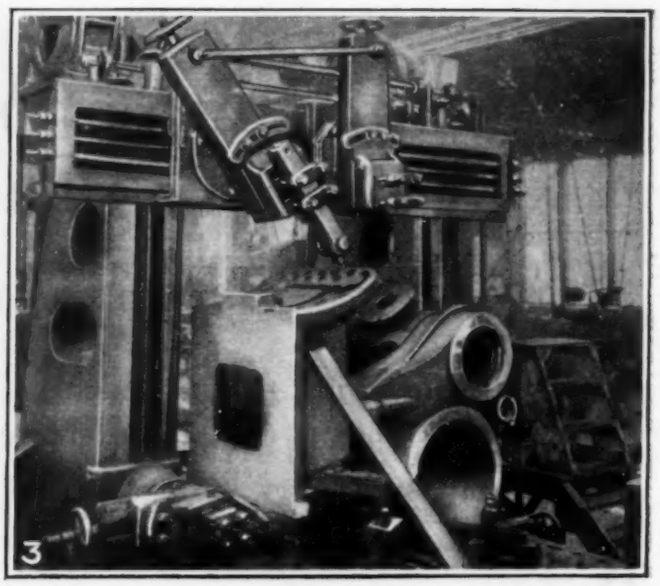
Shown in Figs. 2 and 3 is a cylinder casting for a slide-valve engine, already bored and faced, that is undergoing the operation of planing the valve seat and the radius of the saddle. But one tool can be used at a time on either of these jobs, for the reason that when planing the flat valve seat there is no room for the second head, and when planing the radius, both heads are employed, though but one of them carries a tool.

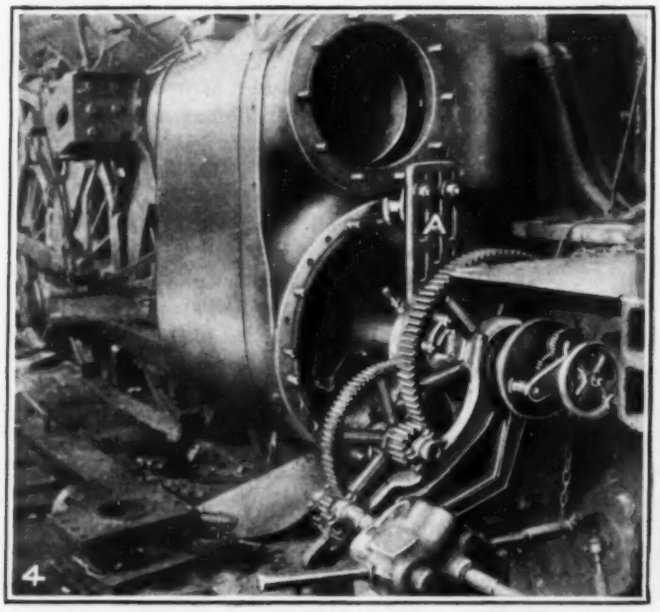
When planing the radius of the saddle as seen in Fig. 3, one of the heads of the planer is clamped tightly to the crossrail, a tool is placed in the toolholder of the vertical slide and the clamping bolts that secure the swiveling head are loosened sufficiently to allow the head to swing about its center of support, but still left tight enough to prevent looseness of the parts that would cause chattering of the tool. The upper end of the slide in which the cutting tool is held is linked to the other head to the right by a bar, and the feed is applied to the second head. As this head moves along the cross-rail the head that carries the tool is caused to swing about its center of support and the point of the tool describes a circular arc.

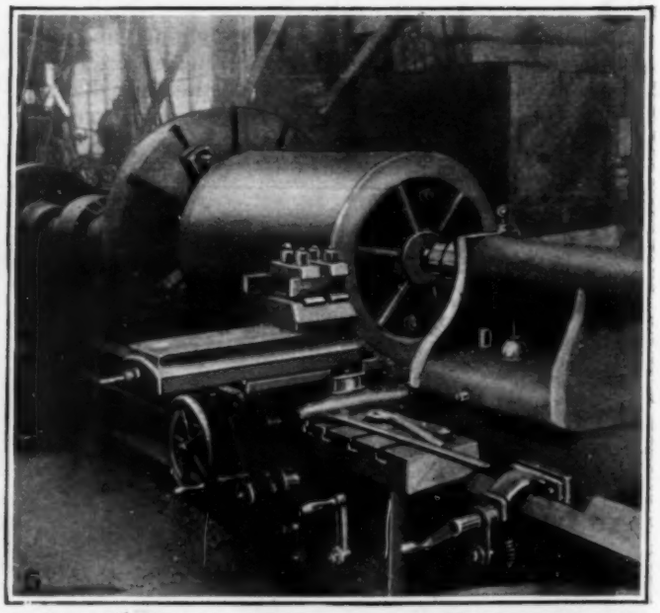
As the radius of the planed surface is arbitrary, the vertical slide of the planer cannot be used to adjust the tool or feed it down for successive cuts. The point of the tool must first be adjusted in correct relation to the center of swing of the swiveling head to produce the desired radius on the work, after which the slide is clamped against further movement and any necessary vertical adjustment is made by moving the entire cross-rail up or down on the housings.

The fourth article. The fifth will be published in an early issue.









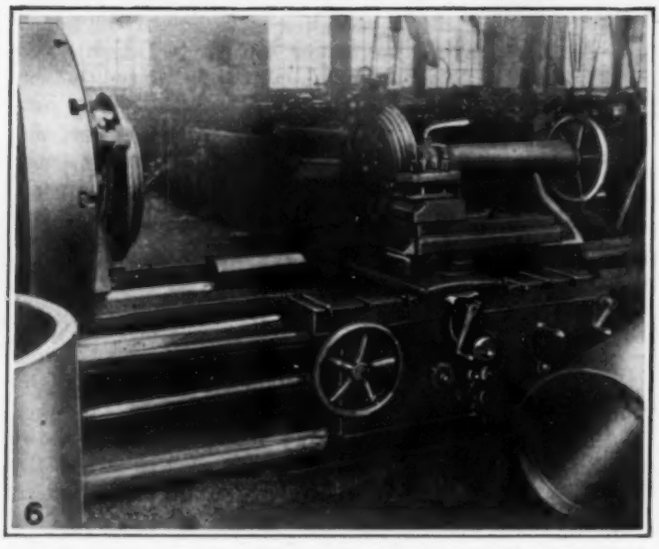


Fig. 2—Planing the seat for a slide valve. Fig. 3—Planing radius of saddle. Fig. 4—Reboring an engine cylinder in place. Fig. 5—Turning a cylinder bushing. Fig. 6—Method of holding the bushings to turn them. Fig. 7—Making a "gas" weld on a cylinder

Fig. 8—Brass joint-ring welded on head

This job is one of the largest, though by no means the only one that comes to this planer. The angle plate to be seen at the end of the table in Fig. 3 has nothing to do with this job except to furnish a backstop for the brace, and that only because it happened to be handy. An hour after this picture was made there was a pair of 6-ft. driving wheels strapped to the plate and both tools of the planer were engaged in removing stock from the counterweights for the purpose of lightening them to bring the parts into balance.

Cylinder reboring is a common job in all railroad shops, and unless it is necessary to dismantle the engine for another purpose the reboring is done with the cylinders in place, and by means of the boring rig shown in Fig. 4. This device is self-contained, being supported at the driving end by the slotted bar *A* which spans the cylinder and is attached by means of nuts on the regular studs that hold the cylinder head, and by a similar plate at the other end if that head happens to be off, or by a bushing in the stuffing box if it is not.

Air Motor for Power

Power may be applied to drive the rig by any means that happens to be available. Because an air motor is most convenient, least in the way of the operators, and involves no undesirable features in the way of moving belts, exhaust steam or gases, or hot piping, it is generally used for the purpose.

A latitude of $\frac{1}{16}$ in. is allowed for cylinder wear, which usually appears in the shape of "out-of-roundness," though sometimes as a taper from each end toward the middle. It is then restored to cylindrical shape and parallelism by reboring, and this operation may be repeated upon any given cylinder until the diameter has been enlarged $\frac{1}{8}$ in., after which the cylinder is bushed.

The first operation on a new cylinder bushing is to bore and face it, which job is preferably done on the Barrett cylinder boring machine if that machine happens to be available, but which can be done to advantage on any of the horizontal boring mills with which the shop is equipped. It then goes to the lathe shown in Fig. 5 to be turned to the proper diameter, preparatory to forcing it into the cylinder.

To hold the bushing in the lathe for the turning operation there are two disks, each having a series of small steps and shoulders in one face. One of the disks is swung up and centered on the large faceplate of the lathe by means of adjustable chuck-jaws, while the other is fitted with a bearing to revolve on the tailspindle, as shown in Fig. 6. The diameters of the several steps on the faces of the disks correspond to standard bore sizes of bushing. It is a simple matter to lift the bored bushing by means of the crane, swing it over the lathe and run up the tailspindle. It is almost like putting the work on centers. A couple of long bolts passing through the bore of the bushing and through both disks clamp the work by end pressure and relieve the tailstock of the duty of pinching it tightly enough to carry against the cut.

Cracked and broken cylinders, if the damage is not too great, are restored to usefulness by welding; a process which is also applied to almost every part of a locomotive. An acetylene generating plant in the yard supplies gas for the torches, and there are portable outfits mounted on special trucks and ready to be wheeled to any place where the welder's services may be needed.

The electric arc-welding process is applied to the reclamation of steel parts and is extensively employed on boiler work wherever it is allowable. The gas torch performs a like service for parts of cast iron, the welding material being Tobin bronze, where tenacity is the desirable attribute in the weld, and manganese bronze to build up parts that are subjected to wear.

Heated Before Welding

In Fig. 7 is shown an extensive welding job on a cracked cylinder—or rather a pair of cylinders, for both were welded. These cylinders were not removed from the engine for the purpose of welding them, but being taken off for another reason, the welder took advantage of the opportunity to do the work conveniently, instead of crawling into a pit beneath a partly dismantled locomotive.

Preheating the part to be welded is a valuable aid in any case, and where the weld is extensive or is done upon a part likely to be affected by the shrinkage strains when cooling, it is a necessity. The cylinders shown in this illustration were preheated by building a fire in them. A couple of sheet-iron covers were fitted into the open ends, holes made in them to admit air and allow the gases to escape, and the cylinders partly filled with charcoal. The fire was lighted by suitable means and allowed to burn during the operation of welding.

When cylinders are welded from the inside, without removing them from the engine frames, it is often necessary to build up around them a temporary furnace of brick, in which a fire is started and allowed to burn until the casting has reached the desired temperature. The bricks are then torn down, the embers

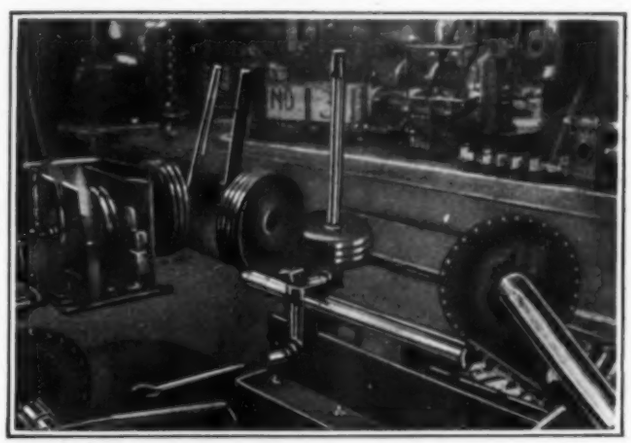


Fig. 9—Getting ready to shrink on a piston

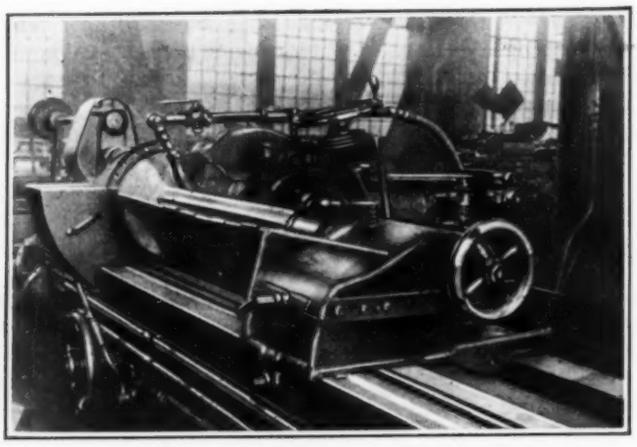


Fig. 10—Grinding a piston rod

raked away and the weld made upon the almost red-hot casting. Some extensive and very successful cylinder repairs have been made in this way.

Another place where the gas welding process is applied, is to the joint between the cylinder and head. Fig. 8 shows a head upon which a ring of soft brass has been welded to form the joint. After a sufficient quantity of brass has been put on, the head is swung up in a boring mill and the joint face dressed off.

A small furnace built up on the floor of the shop and fired with gas is used to heat pistons for the purpose of shrinking them upon their rods. Some of the pistons are one-piece iron castings with the grooves for the rings cut into the periphery, while others have a cast-steel web to which a cast-iron bull ring is riveted. Fig. 9 shows both kinds.

A fixture to hold the rods while putting on the pistons, is bolted to the floor in a convenient position near the furnace, as may be seen in this illustration. The rod rests in V-blocks that are tongued to match a longitudinal slot in the top of the base, and are secured by straps and bolts. When the heated piston is placed on the rod and the retaining nut screwed upon the latter to back it up, it is struck lightly with sledges to drive it to the shoulder on the rod, while at the same time a helper, armed with a long wrench, follows it up with the nut. As this is a taper fit, little persuasion is necessary, and there is seldom any trouble from a piston working loose in service.

New piston rods are finished to diameter by grinding them on the Landis grinding machine shown in Fig. 10, and those that come in for repairs during the overhauling of a locomotive are redressed in the same manner without removing the pistons. This illustration shows a rod with a steel-web piston in place on the machine for this operation. New driving axles, and valve-yokes and stems are also ground on the same machine.

Fig. 11—The locomotive barometer

The Readville shops average about 35 locomotives repaired per month, which is about one and one-half for each working day. In order that the entire working force may visualize the progress of the work and know how the schedule is being maintained, there is a large dial, resembling the dial of a clock, suspended in a conspicuous place near the middle of the shop. From this dial, which is called the "locomotive barometer," everyone—workman and official alike—may read at a glance the number of engines already sent out during the month, as well as the number remaining to fill the monthly complement.

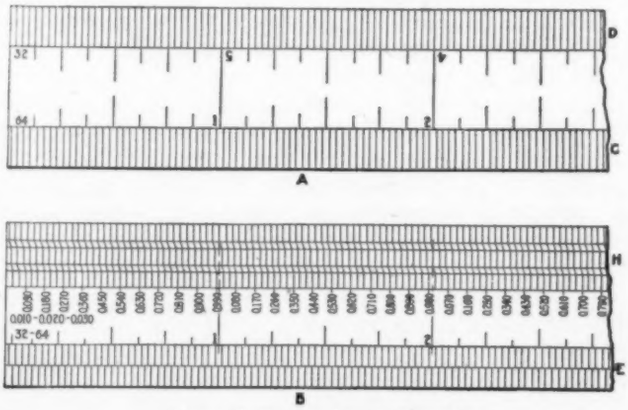
The dial of the barometer, which may be seen in Fig. 11, is graduated to fifty numbered divisions and carries two hands, one red and the other black. On the first day of each month the black hand is set to indicate the number of engines that is expected to be turned out during that month, and each time a repaired locomotive is rolled out of the door the red hand is advanced one step. The photograph was made at noon on the fifth day of the month, and as the red hand points to the number 6 it indicates that the schedule is being maintained and the month's quota bids fair to be fulfilled.

Wanted—A Time-Saving Scale—Discussion

By E. Duchesne

The article by Donald A. Hampson, under the title given above, published on page 996, Vol. 62, of the *American Machinist*, prompted us to design the scale here illustrated, in which opposite sides of one end are shown at *A* and *B*.

Edge *C* is graduated for measuring odd 64ths, the graduations being $\frac{1}{32}$ in. apart. Edge *D* shows ordinary



A specially-graduated scale

$\frac{1}{32}$-in. graduations. Two sets of graduations are shown on edge *E*, the outer ones for 32nds and the inner ones for odd 64ths. These two graduations are for setting calipers or dividers, while the graduations at *C* and *D* are for measuring with the edge of the scale.

The graduations on edge *H*, while spaced 0.030 in. apart, may be read to 0.010 in. However, they could be left out and any other graduation substituted, if desired.

Economy Due to Power Factor Correction

By Erb N. Dittenhofer
Engineer, Research Dept., Gotham Silk Hosiery Co., Inc.

In a full-fashioned hosiery mill the average load conditions are bad, due to the operation of a large number of small induction motors—generally of 1.5 hp., which operate at an average power factor of from 30 to 40 per cent.

These conditions were especially bad at the plant of the Gotham Silk Hosiery Co., as was evidenced by an overall power factor of only 49.9 per cent. The feeder circuits were badly overheated and there was an excessive blowing of fuses. On one circuit in particular a 300-amp. fuse had been substituted for one of 100 amp. and even this blew several times a week. In addition, the two transformers were considerably overheated and there was grave danger of a costly shutdown.

At this time the load conditions were as follows:

1—106 knitting machines on six floors of two old buildings, each floor being driven by a 15-hp. motor.

2—21 knitting machines on the fourth floor of No. 2 building, each driven by a direct connected 1.5-hp. motor. It was on this circuit that the 300-amp. fuses had been installed.

3—85 knitting machines, in a new ten-story reinforced concrete mill, also driven by 1.5-hp. motors. This load was to be eventually increased to 168 machines. One circuit fed the floors from the sixth to the second and another the remainder of the floors. These circuits consisted of 500,000 circ.mil cables with panel boxes on each floor and No. 8 wire feeders to each group of four motors, of which there were six on a floor

4—A miscellaneous load in the machine shop, the winding room, and on the elevators, and the like.

Conditions in January 1924, especially in the new mill, became so bad that although only about one-half of the proposed load was running it was found necessary to take the six group drive floors off central station service and to drive them with an old 75-hp. steam engine. This was done on the advice of the Philadelphia Electric Co. and it relieved the transformers sufficiently to remove all danger of a shut-down.

Two plans for correcting the power factor of the mill were suggested. The first proposed to raise the power factor to the required 90 per cent by the installation of a group of static condensers at the metering point; the second proposed to install individual condensers on all the direct-drive machines and then to add whatever additional correction was necessary at the metering point.

In view of the fact that it would have proved necessary to install a new feeder in the mill at a cost of about $1,400 unless at least some of the correction was applied at the motor terminals, the latter plan was adopted.

The engineers of the National Electric Condenser Co. proposed to install 1.5 kva. of correction on each of the 1.5-hp. motors to raise their power factor to 65 per cent and to install 120 kva. in group correction at the metering point. This would then raise the mill power factor to 90 per cent when the plant was entirely equipped with machinery.

The first step made was to install 78 kva. in individual condensers at the end of the feeders in the new mill and on the 21-machine feeder in No. 2 mill. After this had been done it was found possible to put back the six floors on central station service and to replace the 300-amp. fuse with the original 100-amp. installation. The load in the new mill had been increased by 16 machines and after an additional 93 kva. in individual condensers had been installed the two 100-kva. transformers had cooled down to 159 and 169 deg. F. respectively with a room temperature of 85 deg.

The mill power factor had now been raised from 49.9 per cent to 70.3 per cent.

Before any group correction was installed, it was decided to run a test on the group drive motors in the old mills and the load was found to be badly overmotored and to be operating at a power factor of only 52.7 per cent. The six 15-hp., 900-r.p.m. motors were replaced by two 10-hp. and four 7.5-hp., 1,200-r.p.m. motors with a saving of 40 hp. in a 90-hp. load. These new motors were corrected with 9.5 kva. in condensers applied at their terminals which raised their power factor to slightly better than 91 per cent. This motor change eliminated 37 kva. in group correction as originally planned.

By this time there was a total of 156 individually driven machines running in the three mills; 205 kva. in static condensers had been installed, and the plant power factor was 87.8 per cent.

A study of the motors driving the direct connected machines was next made and it was found that motors with different characteristics than those supplied with the machines could be purchased which, with 1.5 kva. in condensers applied at their terminals, would give a power factor of better than 90 per cent. The use of such motors on the remainder of the machines to be installed plus the installation of 20 kva. in individual condensers, split between the winding room, the machine shop, and the elevators, would entirely eliminate the necessity of any group correction at the metering point.

The last test made by the Philadelphia Electric Co. showed an overall power factor of 91.4 per cent.

The beneficial results obtained by the raising of the power factor from 49.9 to 91.4 per cent may be summarized briefly as follows:

1—The elimination of the power factor penalty. This amounts to about $3,600 a year and is alone a splendid return on the company's investment.

2—A lower power consumption per unit of product.
(B) Kw.-hr./doz. hose—after = 0.46047
(A) Kw.-hr./doz. hose—before = 0.63879

3—Elimination of the necessity of an extra feeder.

4—The showing up of bad motorization which in itself led to an appreciable saving.

5—The cooling of transformers and feeders. Lower fuse capacity (from 800 amp. to 600 amp. in the new mill) with elimination of fuse trouble and better plant operation in general.

6—The removal of all danger of a shutdown.

Few believe that you can turn out a full-fledged mechanic in a trade school. But the idea seems to be growing that it is a paying investment to get a boy beyond the stage of hunting for left-handed monkey wrenches and sky-hooks before he goes into the production shop. It is cheaper to tie up a machine in a school shop for instruction purposes than to interfere with a production line while the boy learns to handle a machine.

Paper to be presented at a conference on "Conservation of Power in Industrial Plants," at the Engineers Club, Philadelphia, February 16, 1926.

A Method of Finding Lead Gears—Discussion

By B. M. Haverstick

On page 629, Vol. 63, of the *American Machinist*, A. L. De Leeuw offers some criticisms on my article which was published on page 419, Vol. 63. I regret, indeed, that the explanation did not make the process as clear as it might have. At the same time, it may be Mr. De Leeuw did not study the method thoroughly.

So far as the inaccuracy of the machine is concerned we cannot say, positively, whether these inaccuracies will favor the job or not. Assume that the machine is imperfect. When used with a gear train, correct only within wide limits, the error in the machine may add to the error in the gear train and, in this way, amount to a serious total. The accuracy of the gear train is, therefore, of considerable importance since it is the only element under our control. An accurate job cannot be made with a perfect machine using a gear train that is not correct even within the closest possible limits.

Naturally, there are many jobs where nothing is to be gained by using an extremely accurate gear train but there are also many others where an almost perfect train is the only thing to fill the bill. This is especially true in the case of herringbone gears and particularly those having a wide face. The lead of such gears need not be off very much to cause the gear to carry a large part of the load on one end of the tooth.

In the discussion of the ratio-table method, quite a number of the different phases were omitted in my original article out of necessity. It was hoped that the reader would be able to pick out those parts for himself. Among the things omitted was the determination of the actual error in the lead generated but this is not necessary if gear combinations of a certain degree of accuracy are used. Our own rule is that the difference between the actual gear ratio and the original may not be greater than 0.000009.

No attempt was made in the original article to find a two-gear combination that might be accurate enough to meet our requirements. As a matter of fact, we do not look for them. It is not always possible to find one and so, in order to save time, we proceed at once to look for a four-gear combination where we know one can always be found.

Another practical reason for not looking for a two-gear combination is that, when one is found, one of the gears is likely to be large, as in the case of Mr. De Leeuw's solution which would require a gear having 109 teeth. Gears with odd numbers of teeth, over 100, are not usually furnished and are made only for special occasions. In our own equipment we have a full set of gears, 24 to 100 inclusive, and by using four-gear combinations this stock will meet any requirements.

In other words we consider it cheaper to figure out a four-gear combination than to make a special gear which may not be used again for a long time. Even if a full set is not available there is much more latitude in using four-gear trains. It must be understood that we can find two-gear combinations by this method because we can, probably, just as quickly and, certainly, as accurately as by any other method.

For finding four-gear combinations the steps we follow are to find the ratio, make up the table, select two or three pairs of numbers from the table which have a decimal near 1 or 0, decide which pair we wish to start with and then add.

In selecting the pair of numbers with which to start we may take from the table any pair we wish but, for reasons which need not be explained here, we usually start with the 2,000 pair. The first number added is used to "clear" the problem of the large decimal and is usually taken from the table, after this first addition, if possible, we use only the selected numbers.

Ratio—1.345678 as published originally

	2000—2691.356
1.— 1.345678	80— 107.65424
2.— 2.691356	2080—2799.01024
3.— 4.037034	26— 34.987628
4.— 5.382712	2106—2833.997868
5.— 6.728390	81— 108.000018
6.— 8.074068	2187—2942.997786
7.— 9.419746	55— 74.01229
8.—10.765424	2242—3017.010076
9.—12.111102	81— 108.999918
10.—13.456780, for proof.	2323—3126.009994
	55— 74.01229
	2389—3200.022284—Satisfactory
Selected numbers	26— 34.987628—E=0.000009
	2404—3235.009912
20— 26.91356	81— 108.999918
6— 8.074068	2485—3344.009831—Satisfactory
26— 34.987628 (1)	E=0.000004
50— 67.2839	
5— 6.72839	
55— 74.01229 (2)	
80—107.65424	
1— 1.345678	
81—108.999918 (3)	

The sixth and eighth pairs are satisfactory and can be factored. In practice it is necessary to find but one.

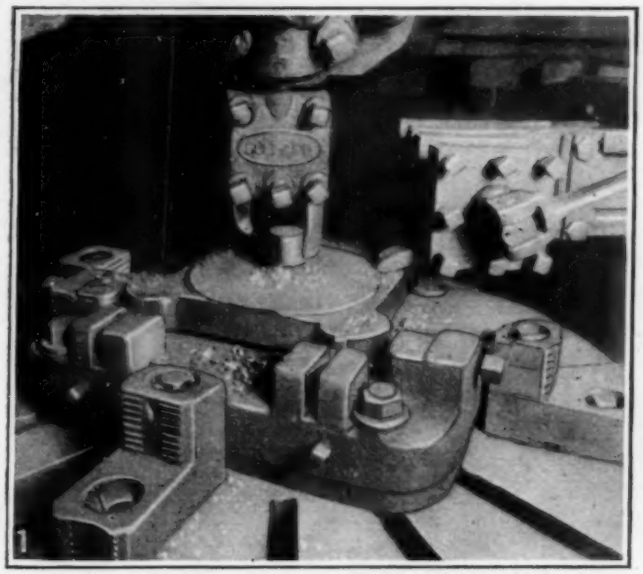
It will be seen from the above that we might go on almost indefinitely and that any reasonable number of combinations can be found, all of which are beyond the accuracy of most other methods. Of course some of these combinations cannot be factored, but that will occur without any other method. In any case, and by any method, we must proceed until we find a pair of numbers both of which can be suitably factored.

In reply to the contention of Mr. De Leeuw that the method is lengthy and involved we will set down every figure used in solving a problem recently worked out.

Ratio—0.7404751

1.—0.7404751	2000—1480.9502
2.—1.4809502	100— 74.04751
3.—2.2214253	2100—1554.99771
4.—2.9619004	77— 57.0165827
5.—3.7023755	2177—1612.0142927
6.—4.4428506	27— 19.9928277
7.—5.1833257	2204—1632.0071204
8.—5.9238008	
9.—6.6642759	Gears—$\frac{34 \times 48}{38 \times 58} = \frac{1632}{2204}$
10.—7.4047510—proof	
Selected numbers	E—$\frac{0.007000}{2204} = 0.000003$
20—14.809502	
7— 5.1833257	
27—19.9928277	
70—51.833257	
7— 5.1833257	
77—57.0165827	

I believe that a thorough study of this method will repay anyone interested in this type of problem.



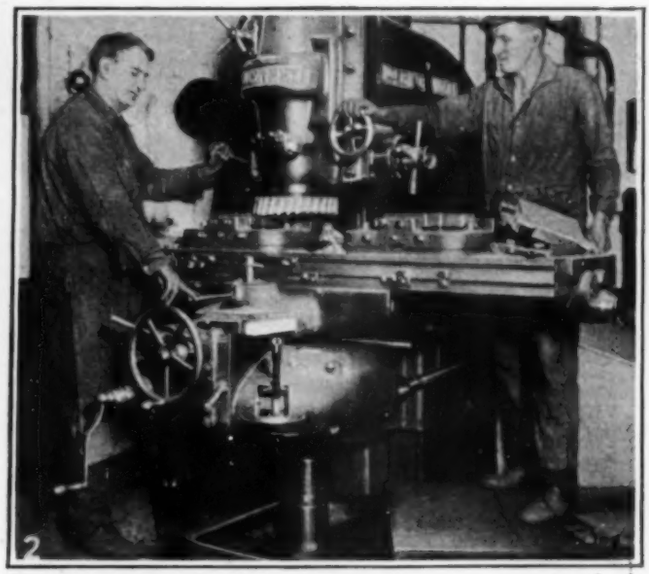


Fig. 1—Turning and facing punch holder. Fig. 2—Milling the flat surfaces

Standardized Die Sets for Punch-Press Work

By Fred H. Colvin
Editor, *American Machinist*

How standardization of the sets makes it possible to use modern production methods and to secure accurate results at low cost

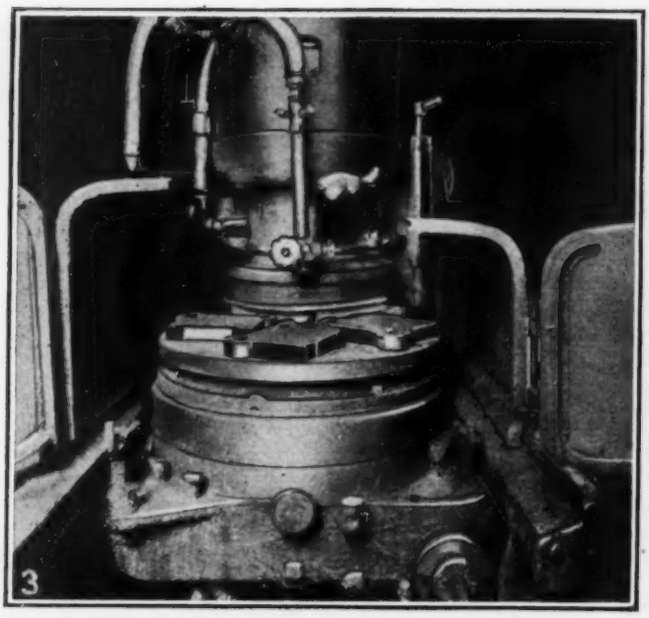
ONE of the signs of progress in manufacturing is the adoption of standard parts for such mechanisms as lend themselves to duplication, without retarding improvements. Less than fifty years ago, many shops were still making their own setscrews, bolts and twist drills, even of the regularly used sizes. Today, the progressive concern buys and uses as many parts as can be made more economically by those who can specialize on them. Ball handles, setscrews, jig bushings and other parts can now be bought in standard sizes at a lower price than the average shop can make them.

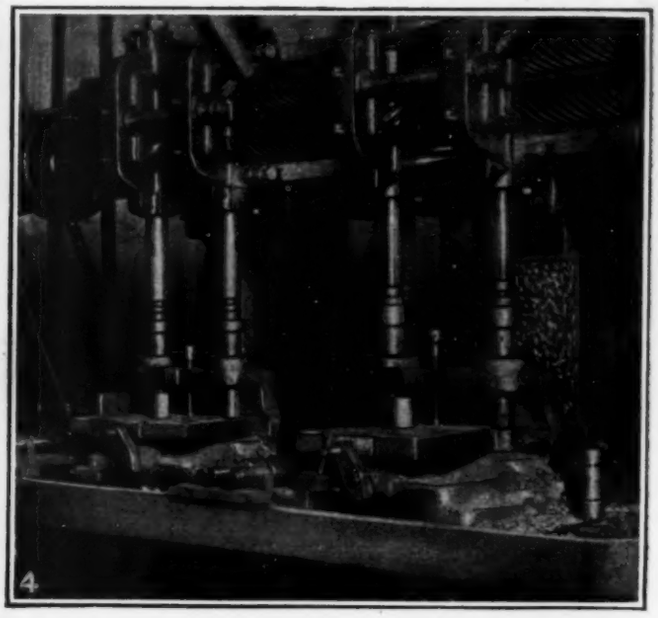
Following this tendency, the Danly Machine Specialties Co., Chicago, Ill., has standardized die sets for punch presses. These sets consist of semi-steel die shoes and punch holders, fitted with suitable leader or guide pins and bushings, and are ready to have special dies and punches fitted to them by the users, to suit any work within their capacity. Standard leader pins and bushings have been adopted for all sizes, being pressed into the bases.

By specializing on die sets and making them in quantities, the parts are made by production methods, utilizing modern machines and securing lower costs than is possible when making them in the small quantities used by the average shop. The methods employed show thorough familiarity with modern machines and practices, as can be seen from the illustrations that follow.

The machines are so arranged in the shop that the work travels in a direct path, avoiding rehandling, and so reducing manufacturing costs. Instead of attempting to have one man run two machines, as was the tendency a few years ago, the high-power machine tools used, make it economical to use two men to a machine in many cases. The use of two fixtures on the table of milling and drilling machines enables the work to be performed with almost no loss of cutting time.

Both sides of the die shoes and the bottoms of the punch holders are rough milled on Cincinnati vertical machines, while the shanks and top faces of the punch holders, are turned and faced on a Bullard vertical-turret machine. These operations are shown in Figs. 1 and 2. Holes for the leader pins and bushings are drilled on Moline "hole-hogs," and the flat surfaces are finished on a Blanchard grinder, as in Fig. 3. Then the holes are bored and reamed as in Fig. 4, using double fixtures. The castings are positioned on three hardened buttons to insure alignment, and both boring bars and





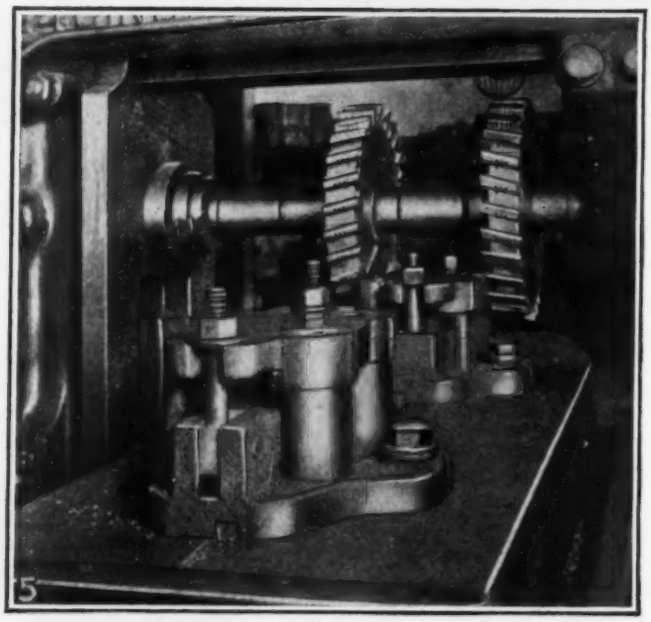


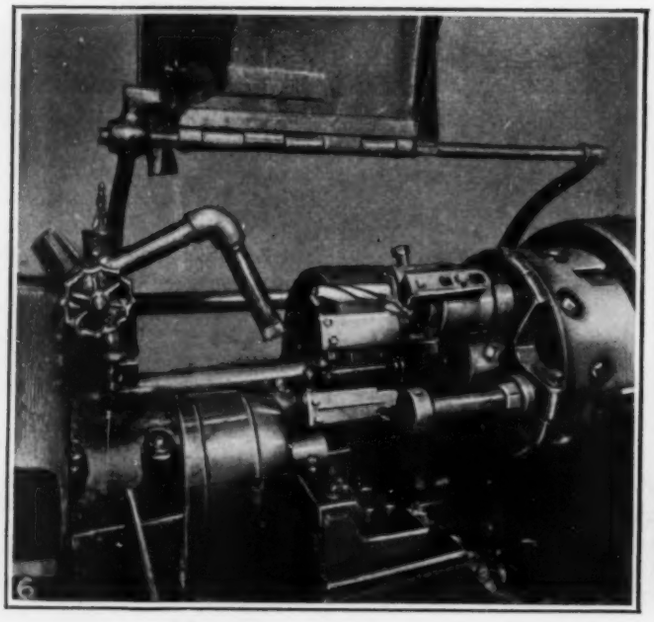
Fig. 3—Finishing flats by grinding

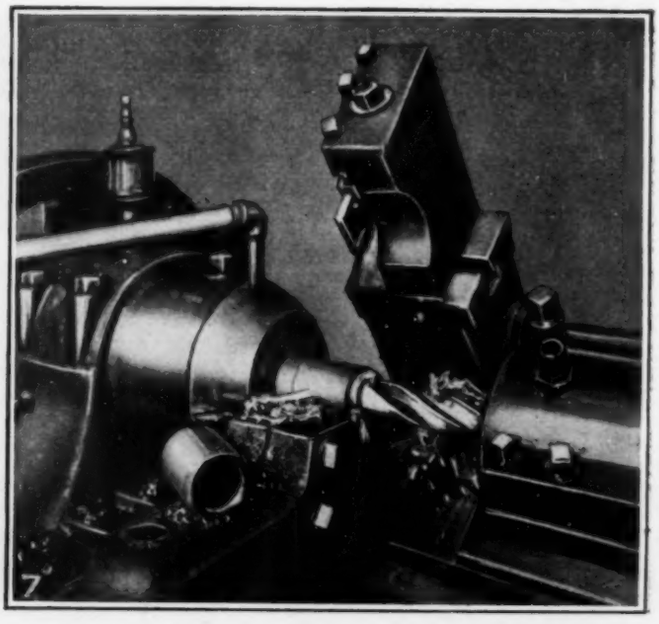
Fig. 4—Boring and reaming for pins

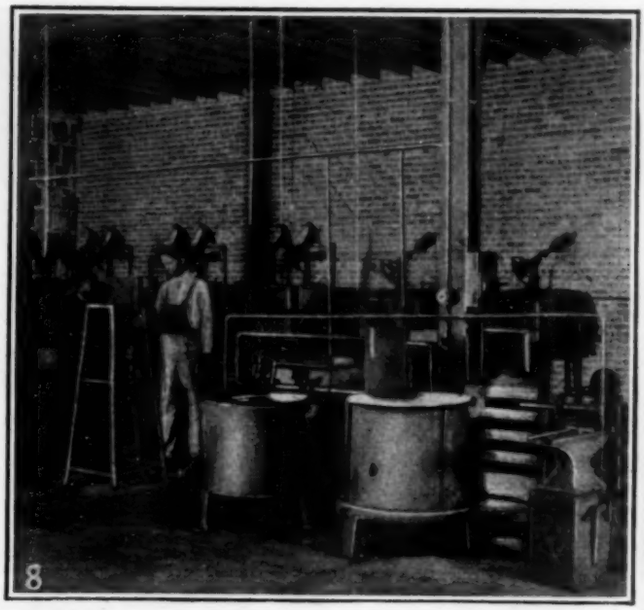
Fig. 5—Milling sides parallel

Fig. 6—Making bushings on Cleveland automatic

Fig. 7—Similar job on a Gridley automatic







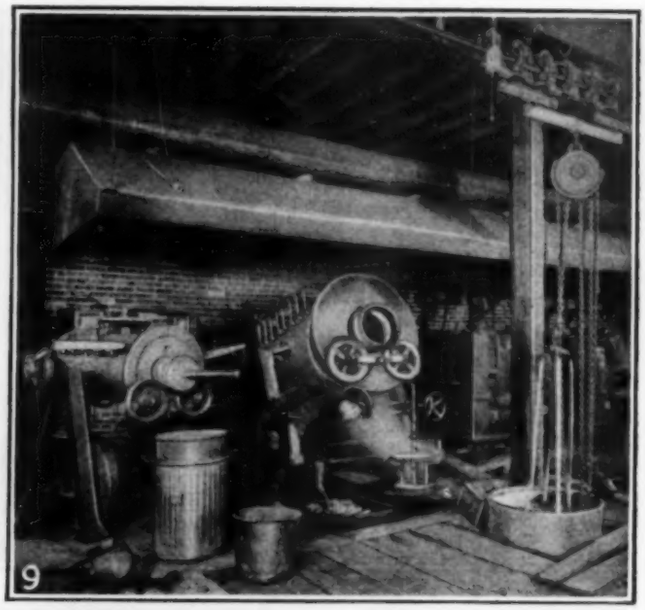


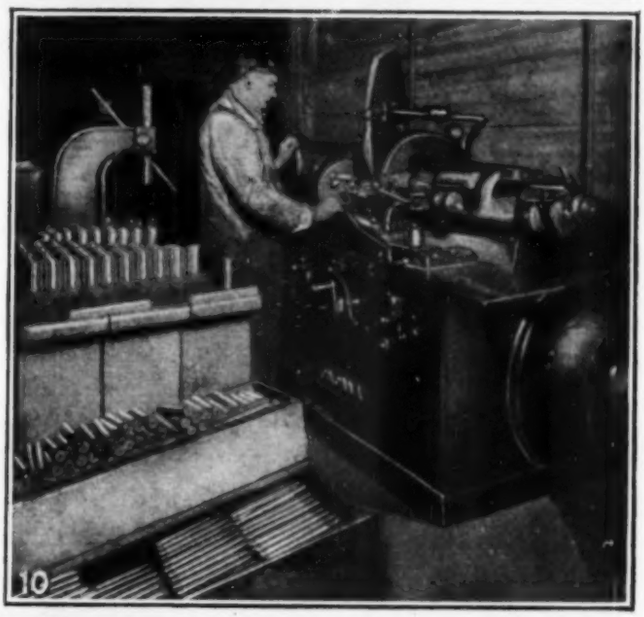
Fig. 8—Part of hardening room

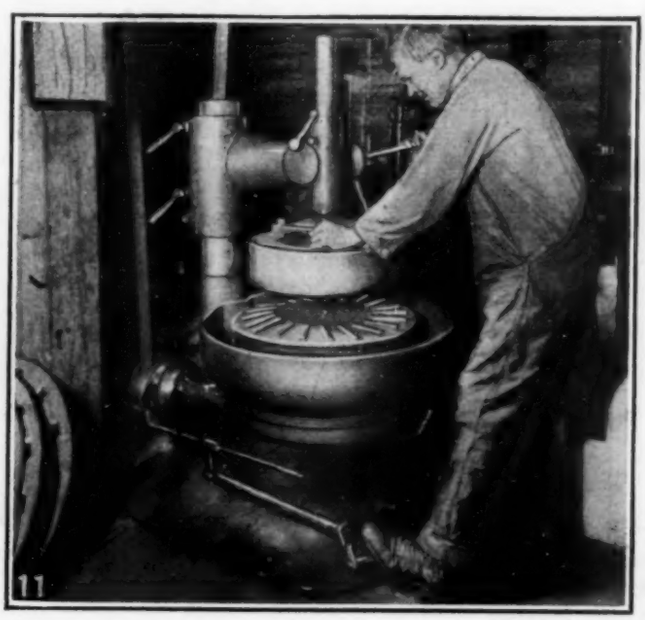
Fig. 9—The rotary furnaces

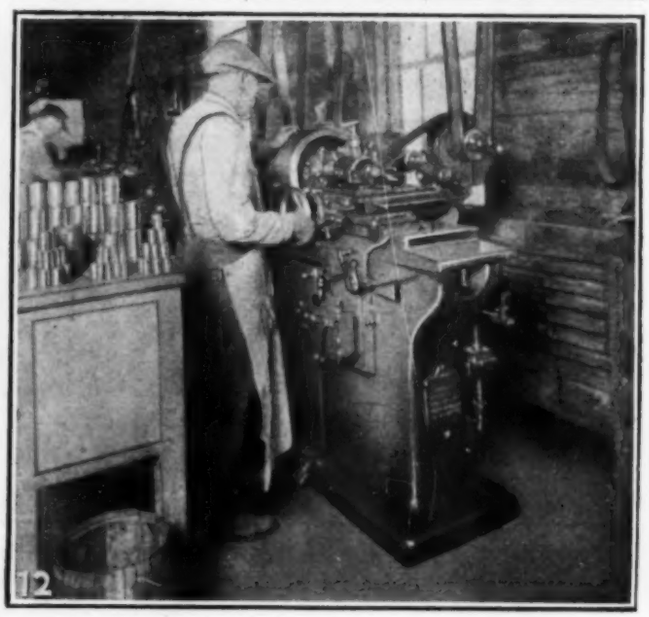
Fig. 10—Grinding pins on plunge-cut machine

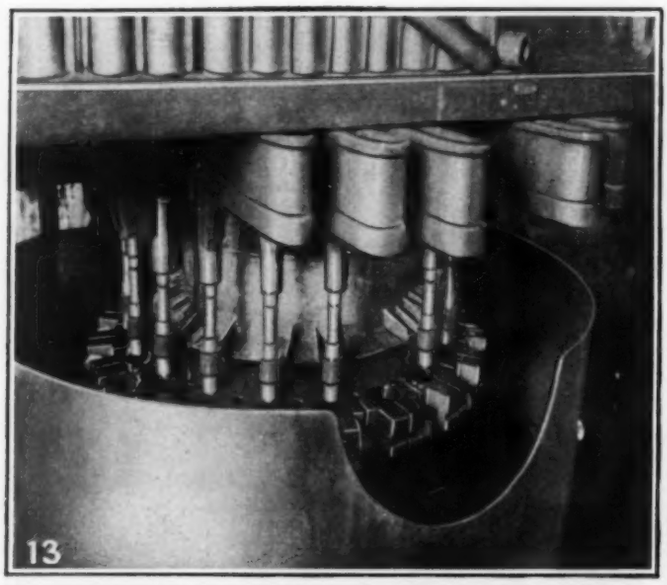
Fig. 11—Lapping the pins

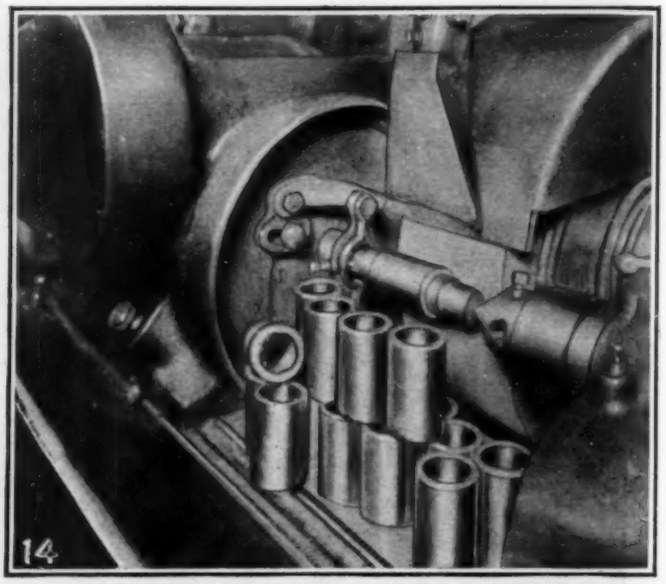
Fig. 12—Grinding the bushings

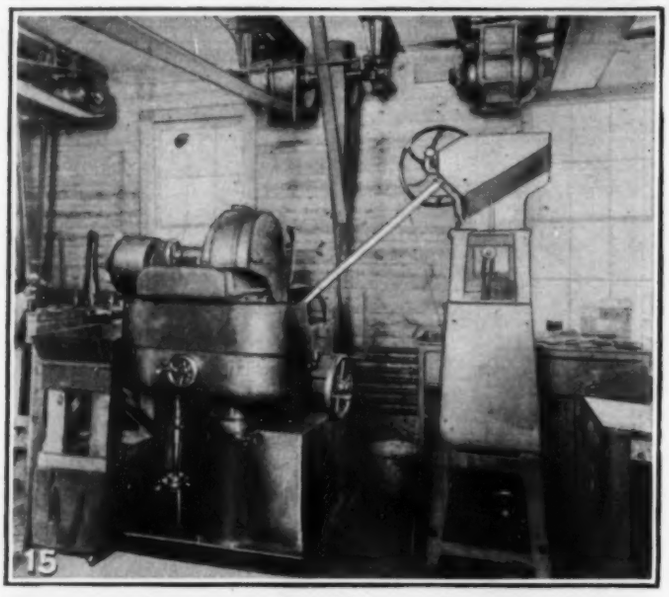


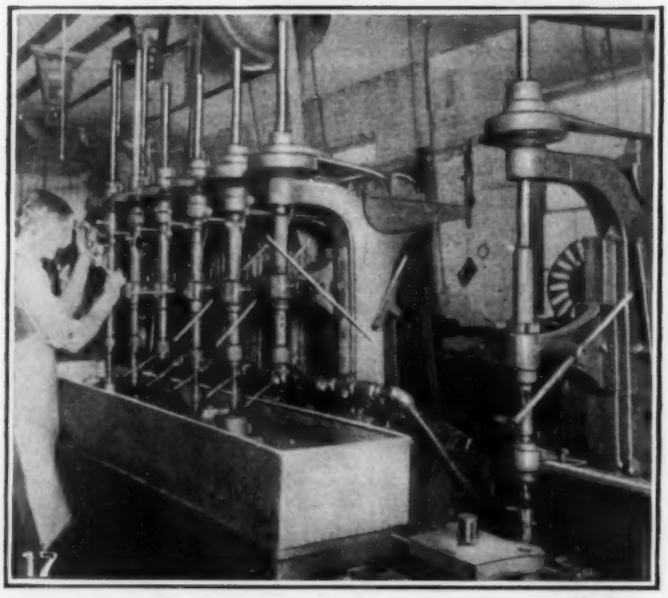












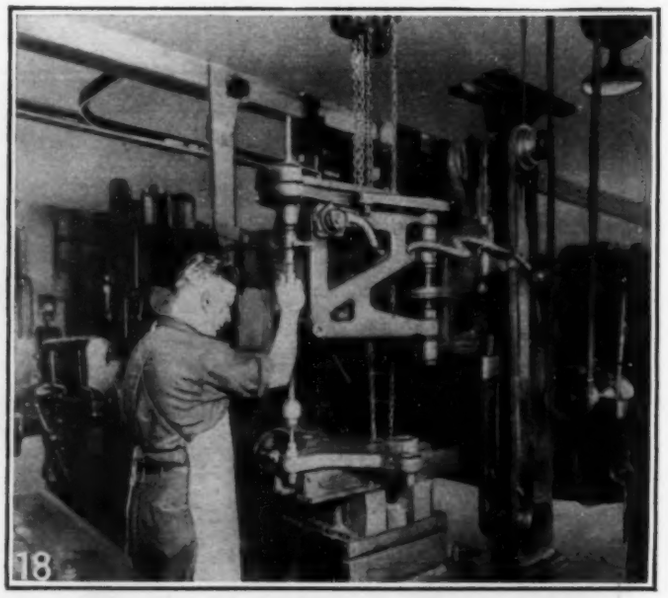


Fig. 13—Lapping on special device. Fig. 14—Grinding outside of bushings. Fig. 15—Magazine feed on centerless grinder. Fig. 16—Pressing in bushings. Fig. 17—Final lapping of bushings
Fig. 18—Single spindle lapping machine

reamers are driven by a floating chuck. Next comes straddle milling of the fronts and backs of the shoes and holders, Fig. 5, completing the work on these parts.

Leader pins, bushings and dowels are made in the automatic screw machine department, which is separate and devoted exclusively to this work. The screw machines range from ½ to 3¼ in. capacity, giving an idea of the sizes of pins and bushings that are manufactured. In Figs. 6 and 7 two of the screw machine operations are shown.

After thorough cleaning, the pins, bushings and dowels go to the hardening room, Figs. 8 and 9, where they are sorted as to size, and handled as experience has shown best for each kind. Dowel pins, for example, are treated in a small furnace of about 100 lb. capacity. Bushings, due to their bulk, go in a 400-lb. furnace, and it is found that a rotary furnace, as in Fig. 9, gives a more uniform "case" on the inside, where it is needed, than the pack hardening method. Leader or guide pins, however, are carbonized by packing in pots. All case-hardened parts are drawn to refine the cores and produce toughness, each furnace being equipped with an electric pyrometer to insure uniform treatment. Samples of each lot are broken and the hardness is checked by Rockwell machines.

Following the hardening, comes the grinding and lapping, on which the accuracy of the die-sets largely depends. Pins are ground on a Cincinnati plunge-cut machine that covers the whole length of the pin. The pins are then lapped on a Bethel-Player machine, Fig. 11, to assure straightness and overcome irregularities.

Rough grinding of the outsides of the bushings, to relieve strains before the insides are ground, is done on a centerless grinder. There is a tolerance of 0.0004 in. and 0.0003 in. is allowed for lapping. The inside diameters are ground on the Heald semi-automatic machines shown in Fig. 12, and then lapped in the fixture shown in Fig. 13, the latter being mounted on a multiple-spindle drilling machine, capable of handling 20 bushings at once. The laps vary in size, each one being progressively larger, and the fixture indexes so that the work is divided between the 20 laps, and a finished bushing is produced at every indexing of the fixture. The bushings are then mounted on mandrels and finish ground on the outside. Dowel pins are ground automatically on the centerless machine shown in Fig. 15, the magazine at the right feeding them automatically to the grinding wheels.

Fig. 19—Inspecting the finished die-sets

The leader pins are pressed into the shoes, and the bushings into the punch holders, on a 30-ton hydraulic press, Fig. 16. Pressing closes the holes in the bushings slightly, so the final lapping is done with the bushings in place, in the multiple-spindle machine in Fig. 17. Bushings in some of the larger punch holders are lapped in the single-spindle machine in Fig. 18. After assembly, the die sets pass a rigid inspection, as in Fig. 19, where all surfaces are checked for parallelism. A hardened parallel between a die shoe and a punch holder must hold a cigarette paper in any position. Leader pins are checked for squareness and for the fit in the bushing. Punch holders must slide on the leader pins freely, and the top of the holder must be square with the shoe face in any position on the pins.

Wanted—A Time-Saving Steel Rule—Discussion

BY RALPH WRIGHT

The article by Donald A. Hampson, under the title given above, published on page 996, Vol. 62, of the *American Machinist*, has prompted me to make a few remarks on the subject.

I can't see the use of a rule graduated in hundredths, but if no one has a use for rules of that kind, why are they made? I believe that the ordinary stock rule having No. 4 graduations will answer nearly all purposes for the general run of work.

If the work is oily, waste can be used to wipe it off. Poor light is not found in up-to-date shops, at least not in any of the shops I have worked in. If the light was poor, I would bring the matter to the attention of the foreman, and if no remedy was forthcoming I would go where the light was good.

I turn out a maximum day's work for a maximum day's pay and I want maximum light in which to do it. I think Mr. Hampson hit it when he referred to poor eyesight. I have a cataract on one eye, and, while it does not hinder my work, I cannot read the words "American Machinist," printed at the top of the page, with my good eye closed.

I do a lot of work that must be accurate within 0.010 in., for which I depend on the sixty-fourth graduations on my scale. When I start to count the sixty-fourth graduations, I begin from the nearest sixteenth, and to count four of them brings me to the next sixteenth. I don't know what kind of work Mr. Hampson is doing, but I know that I could not get along on machine-tool work without my sixty-fourth graduations.

I can't see that I waste much time in turning my rule around to find the proper graduations. I can tell when I see the graduations, just which way it must be turned. Many times I lay the rule down and pick it up the same way, not having to turn it. On some work I machine as many as 16 faces per hour. This means putting in and taking out cutters and bushings, and I can't spend much time in turning rules around without losing in production.

It probably boils down to the fact that different men, in different places, on different kinds of work, have learned to use and like, different kinds of tools.

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Device to Form Radii on the Corners of a Grinding Wheel

BY GEORGE P. JANK

The drawings herewith show a device that was designed for the purpose of rounding the corners of a grinding wheel to the radii required to make the fillets in the work-piece *A*, at the same setting in which the ⅜-in. diameter of the latter is finished by the periphery of the wheel.

The work is done on a standard Norton cylindrical grinding machine, using a wheel of 4½-in. face. The table of the machine is allowed to traverse a distance of approximately 3½ in. while grinding the parallel portion of the work, and is then moved by hand to the right and left limits, respectively, to form-grind the fillets.

The body of the device is made of cast iron and has at each end an upwardly projecting lug into which is fitted a steel center-bushing, so that when the deivce is placed into position to use, it is located with respect to the center line of the work, and is also clamped in position by the center points of the grinding machine.

In the body of the device, two square-sectioned grooves are machined to the arcs of circles as may be seen to advantage in the plan view. The center of radius of each groove is definitely located with respect to the center line of the device, to correspond in each case with the center of radius of the fillets in the work; that is, the distance *B* and *C* on the plan view must coincide with the corresponding measurements upon the work.

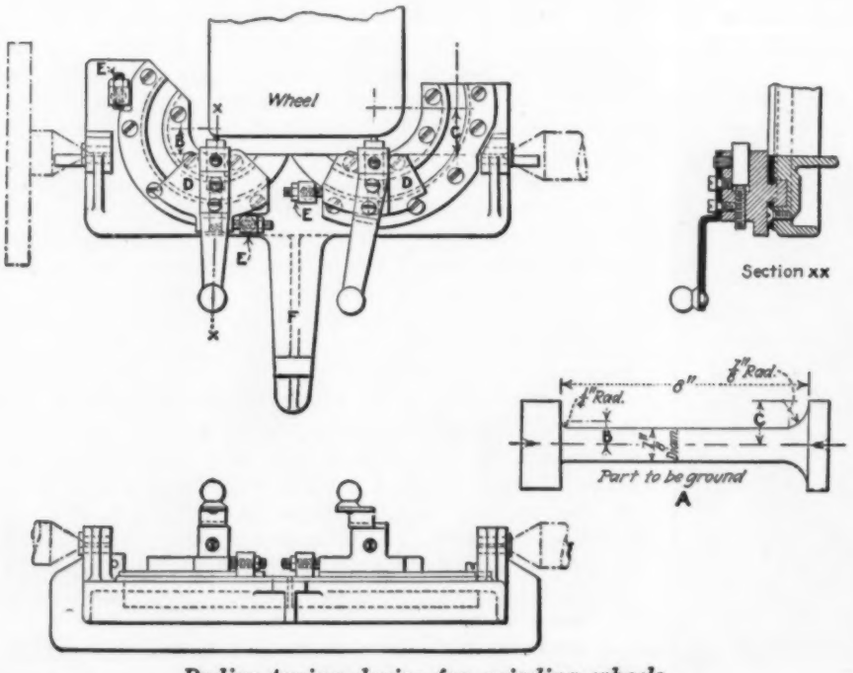
On the underside of each of the two carriers *DD* a T-shaped rib is machined to fit and slide in the respective grooves. Flat, segmental gibs of steel, held to the body of the device by countersunk-head screws, confine the ribs in the grooves without shake, yet permit the carriers to be moved with all the freedom necessary through an arc of 90 degrees.

Adjustable stop screws *EEE* limit the movement of the carriers. At the extremity of movement of the right-hand carrier, however, there is no stop screw. In its place one of the gib screws has a projecting fillister head against which the carrier strikes to limit its movement.

The diamond turning tools are set in short, round holders in the usual way, and these holders are held in the carriers, as may be seen in the sectional view, by headless setscrews and backed up by similar screws to facilitate fine adjustments. One side of each of the lugs in which are the center-bushings, is machined to a distance of $\frac{7}{16}$ in. from the center line of the device, so that a straight-edge placed across these two finished surfaces, provides a locating point to which to set the diamonds.

Offset handles are attached by screws to the carriers in which the diamonds are held to facilitate the manipulation of the tools. The extension *F* from the body of the device, rests upon the raised rib of the machine table and prevents the device from swinging about the centers. When truing the wheel this extension is held down by one hand.

The face of the wheel must be trued first, then the device is placed on the centers, the positions of the diamonds adjusted or verified by applying the straight edge, and the wheel fed in until its face touches the diamonds. The handles are then moved to right and left, respectively, by the disengaged hand until the movement of the carriers is arrested by the stopscrews.

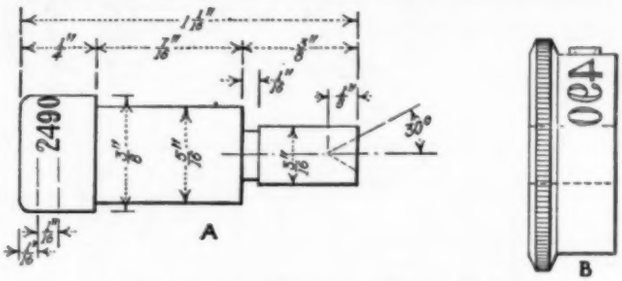


Radius truing device for grinding wheels

Numbering Screw-Machine Parts

By H. B. Schell

The small steel piece shown at *A* in the illustration, made on a Brown & Sharpe automatic, was to be marked with a four figure number. In view of the quantities made, stamping was out of the question. An attempt was made to roll on the numerals similar to knurling. Since the figures did not reach all the



The work and the numbering roll

way around the piece, and consequently did not keep the roll in motion, the only result was to chew up a band on the place to be numbered.

The numbering roll shown at *B* proved to be the solution of the difficulty. The roll was made wide enough to project beyond the end of the piece and on to the portion that was afterward cut away by the cutoff tool. This portion was knurled as shown.

The action of the knurled portion was to make the numbering roll and the work revolve in unison. Of course, the diameters of the work and of the knurled section of the roll must be in the correct relation or the numerals cannot be expected to register.

The knurl marks are cut away when the piece is cut off the bar.

A Multiple-Operation Press Tool

By John Strama

Oftentimes two or more press operations may be combined in one by means of suitably designed tools. A case in point is the tool here shown to combine the five operations of blanking, drawing, forming, trimming and piercing out the center of the ferrule as shown in Fig. 1 in one stroke of the press. The drawing, Fig. 2, is combined to show at the left of the vertical center line, the various parts of the tools as they appear when the gate of the press is at the top of its stroke, while at the right of the line, the relative position of the parts at the bottom of the stroke is indicated.

The ferrule is made of 0.020-in. gage cold-rolled steel, and the work is done in a single-acting press. The blanking punch *A* is screwed into the ring *B*, above which is the heavy coil spring *C*, so calculated as to deliver ample pressure upon the punch to blank out the stock, yet to allow it to recede as the press gate continues its downward movement. The blanking die *D* is sheared about $\frac{1}{16}$ in., which reduces the cutting pressure required to one-half.

The blanking die is held in place by the stripper *E*, which is secured to the die shoe *F* by means of fillister-head screws. The combined drawing die and trimming punch *G* is secured to the punch-holder *H* by the large fillister-head screw *I*, passing through the shank of the holder.

This combined die and punch *G* has a small shoulder at *J* upon its outer surface to serve as a retainer for the ring *B*, and at *K* a shoulder in the bore serves a similar purpose for the knock-out *L*; both parts being held to the respective shoulders under spring tension.

Inside the blanking die *D* is the drawing ring *M*, which is made in two pieces and rests upon the plungers *N*, by which the support is transferred to the washer *O* above another heavy coil spring below the press bed. The drawing punch, or post, *P*, sets in a recess in the die shoe and is held down by a shouldered stud upon which the lower spring mechanism is assembled.

In operation, the strip of material is fed through the die from the operator's right hand, as the illustration Fig. 3 will show. As the press gate descends, a blank is cut from the strip of material by the punch *A*, is gripped between the face of that punch and the drawing ring *M* in the die, and, as the gate continues to descend, is drawn over the post *P* by the die *G*; as may be seen in that part of the drawing Fig. 2 to the right of the vertical center line.

The outer part of the ring *M* bottoms on the shoulder in the recess of the die shoe, stopping the punch *A* and causing the coil spring *C* above it to be compressed. During the remainder of the stroke, the tool *G* is turning and forming the flange of the ferrule into its final shape. This flange is formed around the rounded end of the annular tool *G*, between it and the formed upper surface of the inner member of the ring *M*, and is under considerable pressure.

As the press gate has not yet reached its final posi-

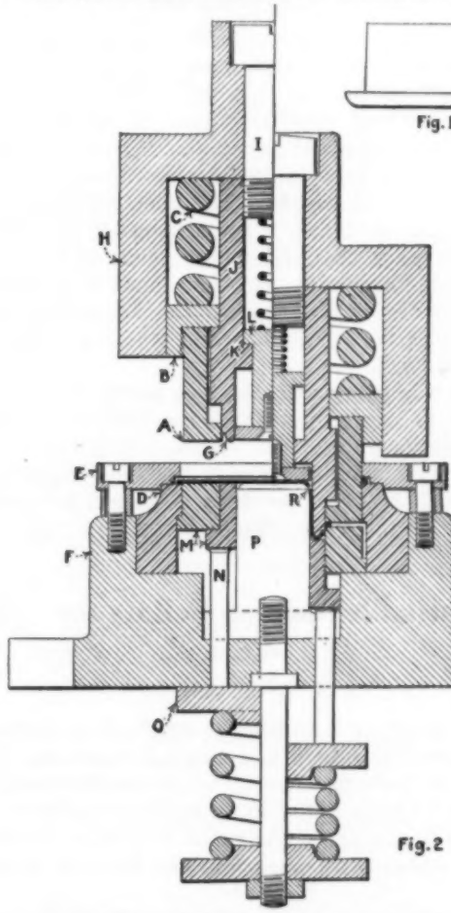


Fig. 1—The ferrule to be made
Fig. 2—Combined drawing, showing relative position of parts at both ends of stroke

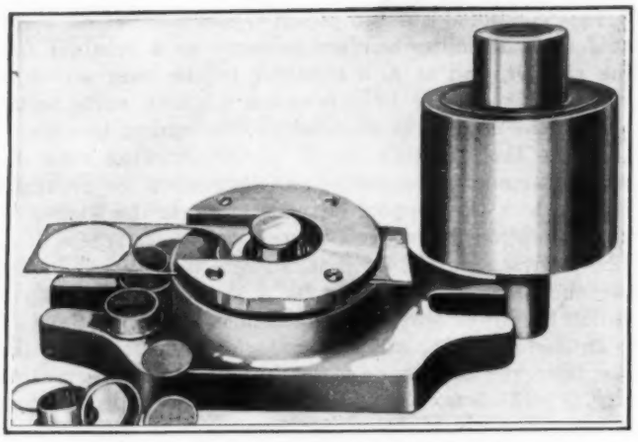


Fig. 3—A photograph of the tools

tion on the down stroke, and the grip of the tools prevents further drawing of the stock, the center of the shell is pierced out by the sharp upper corners *R* of the drawing post. On the up-stroke of the press the ferrule is ejected by the drawing ring and is carried out of the tools by the next advance of the stock.

This combination is working successfully on steel, as above described, and also upon a slightly modified shape of product in aluminum.

That Odd-Sized Bushing—Discussion

BY CHARLES DOESCHER

Referring to the article by H. W. Myrick, under the title given above, and published on page 965, Vol. 63, of the *American Machinist*, it seems to me that a much easier and better way would have been to have hardened the bushing in a small gas furnace or a bunsen burner, both of which are part of the equipment of nine out of ten present-day toolrooms. The bushing could then be held by slipping it into a round loop on the end of a piece of wire, so that the flange would rest on the loop. It would then be a very easy matter to quench the bushing when it has reached the hardening heat, preferably under the stream of water which would make the hole glass hard.

Quenching a bushing with the hole partly plugged by a rod, and with a cross pin under the bottom, prevents the quenching medium from circulating through the hole as it should, with the result that the bushing is hard outside, but not as hard as it should be on the inside, where all the wear actually comes.

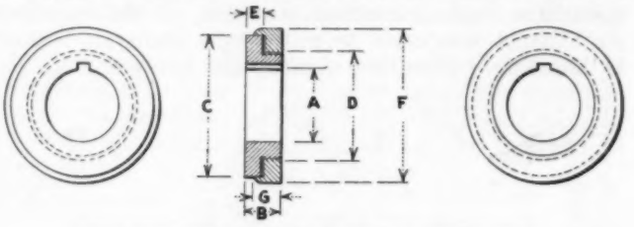
Adjustable Spacing Collars for Milling Cutters

BY D. A. ROGERS

The spacing collars shown in the illustration are made of machine steel, threaded and screwed together. The threads are 20 per in. The inner or smaller collar is graduated in 50 equal divisions on its outer surface, and the beveled edge of the outer collar is provided with a zero line by which the graduations can be read, as on a micrometer.

Each division, as it is brought opposite to the zero line, indicates a change of thickness of 0.001 in. However, since the divisions are from $\frac{1}{8}$ to $\frac{1}{4}$ in. apart, according to the size of the collars, it is a very easy matter to adjust the thickness to a much closer amount by estimating the position of the graduations in relation to the zero line.

The table under the drawing gives data for making ten sizes of collars. While collars of this kind provide



No.	A Size	B Thick	KEYWAY Width	KEYWAY Depth	C	D	E	F	G
1	3/4	3/8	1/8	1/16	1 1/2	1 1/8	3/16	1 5/8	5/16
2	7/8	3/8	1/8	1/16	1 1/2	1 3/16	3/16	1 5/8	5/16
3	1	7/16	5/32	1/16	1 7/8	1 1/16	7/32	2	3/8
4	1 1/4	1/2	3/16	3/32	2 1/8	1 9/16	1/4	2 1/4	7/16
5	1 1/2	9/16	1/4	1/8	2 3/8	1 13/16	9/32	2 1/2	1/2
6	1 3/4	5/8	1/4	5/32	2 5/8	2 1/16	5/16	2 3/4	9/16
7	2	3/4	5/16	5/16	3 1/4	2 1/16	3/8	3	9/16
8	2 1/4	3/4	3/8	3/16	3 1/4	2 3/4	3/8	3 1/16	9/16
9	2 1/2	13/16	3/8	3/16	3 1/2	3	13/32	3 11/16	5/8
10	3	13/16	7/16	3/16	4	3 1/2	13/32	4 3/16	5/8

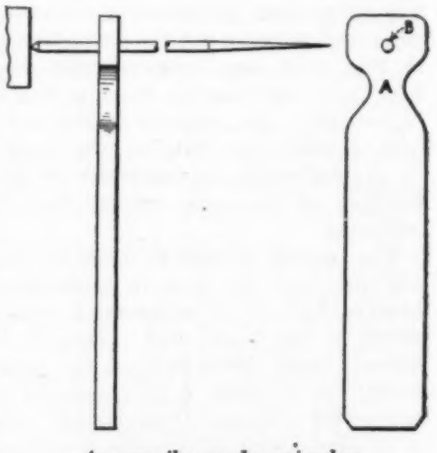
Adjustable spacing collars

means for very accurate adjustment of the space between milling cutters, the cost of making them is quite small. The use of such collars eliminates the necessity for making collars of paper or shim stock to go between the regular collars generally used for spacing.

An Inexpensive and Reliable Wiggler —Discussion

BY CHARLES DOESCHER

The wigglers described by S. B. Richey on page 935, Vol. 62, and J. T. Towlson on page 747, Vol. 63 of the *American Machinist*, brought to mind one of the least expensive wigglers I have ever seen. It was made by a tramp machinist and given by him to one of our toolmakers. Since it has given reliable service for years, I am sure a description of it will be of service to brother toolmakers.



An easily-made wiggler

The holder was made from a piece of leather belting, $\frac{3}{8}$ in. thick and was cut out as shown at *A* to make it flexible. The hole *B* is a tight, friction fit for the wiggler and holds it securely in any position.

Since the end that holds the wiggler gives to any slight pressure, the wiggler can wiggle without any appreciable amount of friction.

Standard Hose Connections for Welding Equipment

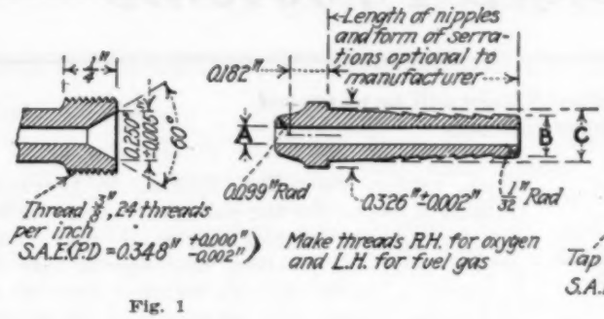


Fig. 1

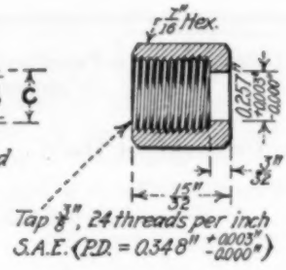


Fig. 1 (at left)—Standard connections for "A" size hose

Fig. 2 (below)—Standard connections for "B" size hose

In order to eliminate the inconvenience in connecting up one make of torch with a different make of regulator or vice versa, the manufacturers of gas welding and cutting equipment have established a standard for hose connection, nuts and nipples for both torches and regulators.

In establishing the standard design for hose, nuts and nipples careful consideration was given to adopt a design of nut and nipple and size of thread that would produce a convenient hose connection sufficiently large to permit a plentiful supply of gas to pass through the nipple and yet avoid a clumsy connection or one heavier than necessary.

A second consideration was the elimination, as far as practicable, of the possibility of placing an oxygen hose on a fuel-gas nipple, or vice versa, and for this reason right-hand threads were adopted for oxygen and left-hand threads for fuel gas. It was also recommended that the oxygen and fuel-gas nuts be marked with distinguishing letters and that the fuel-gas nut be made with a groove around the hex to make it clearly distinguishable from the oxygen nut. A third consideration was the avoidance of exposed conical or rounded seats that might be damaged if struck.

In order that the new standard insures interchangeability of parts made by various manufacturers, it will be necessary to require manufacturers to hold certain dimensions within the limits shown. In Fig. 1 and Table I are shown the "A" size nut and nipple ordinarily used for small torches, and in Fig. 2 and Table II are shown the "B" size nut and nipple, ordinarily used on large torches. The "B" size will be the standard for regulator hose connections.

Table I—Standard Sizes for "A" Size Hose

Hose	A	B	C
3–16 in.	0.093 in. +0.001 in. −0.000 in.	0.187 in.	0.248 in. +0.000 in. −0.005 in.
1–8 in.	0.062 in. +0.001 in. −0.000 in.	0.125 in.	0.187 in. +0.000 in. −0.005 in.

Table II—Standard Sizes for "B" Size Hose

Hose	A	B	C
3–8 in.	0.250 in. +0.003 in. −0.000 in.	0.375 in.	0.430 in. +0.000 in. −0.005 in.
5–16 in.	0.187 in. +0.002 in. −0.000 in.	0.3125 in.	0.375 in. +0.000 in. −0.005 in.
1–4 in.	0.125 in. +0.002 in. −0.000 in.	0.250 in.	0.312 in. +0.000 in. −0.005 in.
3–16 in.	0.093 in. +0.001 in. −0.000 in.	0.187 in.	0.250 in. +0.000 in. −0.005 in.
1–8 in.	0.062 in. +0.001 in. −0.001 in.	0.125 in.	0.187 in. +0.000 in. −0.005 in.

The manufacturers are permitted to vary that part of the design which does not interfere with interchangeability. For this reason standard and optional requirements have been definitely set forth as follows:

Standard requirements—size, type and kind of thread; angle and outside diameter of female seat; radius and distance of radius center of male seat from nipple shoulder; diameter of nipple shoulder; diameter of hole in nut; small and large diameters of hole nipples and diameter of drilling through hole.

Optional requirements—Material. Strength equal to or greater than free turning high brass; diameter of drilling through male fitting; form of end of nipple, except seat section, as covered in "C" under "Standard"; length of hose nipple; type and number of serrations on hose nipple; a second shoulder equal to the large diameter of the largest nipple to extend through the hole in the nut for appearance and to be used or omitted for smaller diameter nipples, and the length and the location of hexagon section on nut.

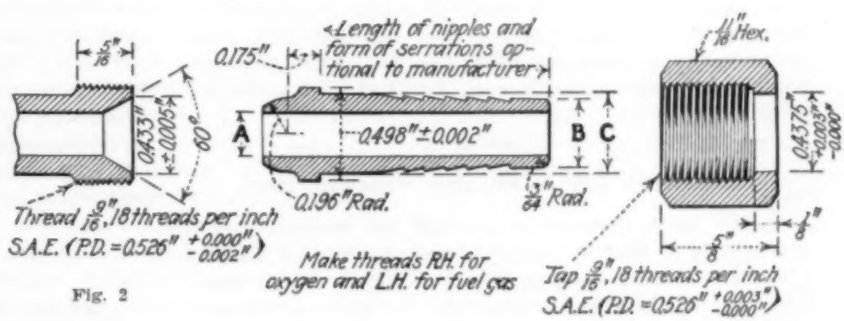


Fig. 2

After January 1, 1926, manufacturers who have accepted this standard will make all new equipment with connections that are in accordance with the standard and will provide means by which users of present equipment can connect up with the new apparatus.

Approved by the Board of Directors of the American Welding Society, October, 1925.

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Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Pipe Tap Sizes to Thread a Straight Hole

Q. Please tell me the exact diameter to finish a ¾-in. and 1½-in. pipe tap to thread a hole straight through a piece of material.

A. We suggest that the outside diameter in each case be taken at a point four threads from the end of the standard pipe plug gage. On a ¾-in. plug gage, the diameter at the end thread is 1.0094 in., and on a 1½-in. plug gage the same diameter is 1.847 in.

From these data, and knowing that the taper of a standard pipe thread is ¾ in. per foot, you can readily figure the diameter.

Organizing a Manufacturing Company

Q. I have a small amount of capital and propose to organize a company to manufacture and market, in quantity, an electrical household utility whose manufacturing cost will be low and whose selling price will show a reasonable margin of profit. An analysis of the field shows 25 manufacturers in the business at the present time. The design and efficiency of operation of the product I propose to manufacture, however, is such that competition will not be a serious factor, once I have completed the organization.

I desire to dispose of stock in forming this company, but do not know the proper procedure to follow in order that I shall not lose a controlling interest, or at a later date be forced out by others with larger financial backing. I will appreciate your recommendations.

A. There is, in our estimation, but one correct way of starting any industrial organization and that is to locate and consult Attorneys-at-Law who are expert in this particular line. After you have located such an expert and have retained him for your purposes, you can take up and settle each detail of the course you propose to follow.

Lubricant for Blanking Silicon Steel

Q. We have a quantity of blanking work to do on thin sheets of silicon steel and have experienced trouble. The steel is very hard on the tools due to its abrasive nature. Our finished parts must be quite clean with the result that we must either run the blanking operation dry or with a lubricant that will evaporate without leaving any residue. Perhaps you can recommend one that will satisfy both conditions.

A. Rather than recommend an oil blindly we are making a number of suggestions as follows:

Check your blanking work at the press to determine if there is any mill scale on the material being blanked. If there is, this is probably your principle source of trouble and the steel should be pickled prior to the blanking operation. Lubrication will not help this condition, rather, we believe tending to aggravate it by forming a binder for the particles that are acting as an abrasive on the cutting edges of your tools. One method, short of pickling, that should help would be to install a nozzle through which a shot of air could be directed as your dies between each hit to blow away the loose particles.

If the trouble is within the steel itself and not a matter of loose scale we are of the opinion that the toolsteel of the dies could be improved. As you probably know, hardness is not necessarily a measure of wearing quality. On this point, we suggest that you put your problem to a number of the toolsteel makers for their recommendations as to the proper steel to use and the methods to employ in its heat treatment.

These companies will also be in position to recommend a lubricant, although, from what you say, we judge your best solution is in removing the scale or correcting the die material. Any oil of sufficient body and oiliness to do your work will be difficult to remove unless you can pickle the parts or put them through a washing process after they have been blanked.

Speeds and Feeds for Cutting Keyways

Q. We are cutting ⅜-in. keyways in cold-rolled shafting ⅛ in. deep, with 3x⅜-in., 22-tooth high-speed milling cutters. The teeth are solid and the cutters themselves are new. We are running three of them at one time and wish to ask at what speed the arbor should run, and how fast we should advance the feed.

A. We suggest that you operate the feed at between 8 and 9 in. per min. with a corresponding speed equivalent to between 50 and 60 ft. per min. at the outside edge of your cutters.

It would help materially, providing you are starting the keyway at the end of the shaft, to grind the shaft corners off where the keyway is to start, as this will prevent a good deal of chatter at the beginning of the cut. The data for this information have been taken from the *American Machinists'* Handbook.

Spline Shaft Design

Q. Please tell me where I can secure complete data on standard spline shaft design that will give me the correct dimensions for a sliding fit under full load conditions.

A. We suggest that you write to the Society of Automotive Engineers, 29 West 39th St., New York City, for copies of the handbook pages pertaining to this particular problem, specifying that you desire those dealing with the length of the spline as well as all of the other dimensions. These data are also contained in several of the handbooks compiled especially for use in the machinery industries.

Technical Abstracts

Continuous Furnaces

M. H. Mawhinney, of the Tate-Jones Division, General Furnace Co., says that the effect of the changes in production methods along the lines of continuous and automatic arrangements has in the last few years begun to be felt in the heat-treating departments. At the present time the question of continuous furnaces enters into the selection of furnaces for practically all purposes. The first question brought out is the life of material under heat and high temperature. Care must be exercised in heating material that it will stand up to these temperatures. One point worth noting is the great importance of fuel economy from which it appears that it is profitable to pay out considerable money for repairs if any reduction can be effected in fuel consumption. Another point is that the increased maintenance of continuous furnaces over the batch type is so small that in most cases the saving of one man's time at ordinary labor costs would more than pay for the investment, whereas more than one man can generally be eliminated and there are other additional advantages resulting from continuous operation.—*Fuels and Furnaces*, Jan., 1926, p. 33.

Sheet Metal Tools

Producing parts from sheet metal is rapidly becoming one of the most important lines of industry, says C. E. Stevens, chief engineer of the White Sewing Machine Co. Costs can be reduced by replacing present parts with sheet metal. If the design is given a small amount of thought castings can in many places be replaced with pressed pieces, and the problem that plants have to solve is to produce these parts at a low cost. It goes without saying that a large percentage of dies for press work, especially on the small or medium size parts, consist of piercing, blanking, shaving or simple forming dies and, except for the location of holes or profile of the blank, the dies could be of the same general construction.

An inspection of the die store room will show dies of all shapes and sizes, making it necessary to have a great many bolts, clamps, or special holding devices in order to make a set up. Much time is lost in hunting for special bolts and clamps and in this time a good many pieces could be produced. The number of set up men would also be reduced. All these factors spell overhead, which has to come out of the profit when competing with another plant.

By having die shoes with a clamping flange of the same thickness, it enables the set up man to use temporary tools for the heavy production, for in either case the cost per piece takes in tool cost as well as production cost. For producing parts for experimental purposes it is often necessary to make several hundred or a thousand parts so as to give the most parts actual tests or runs before tooling for production. —*Forging-Stamping-Heat Treating*, Jan., 1926, p. 18.

Tool Steels

J. P. Gill and M. A. Frost of the Vanadium Alloys Steel Co., discussing the chemical composition of tool steel, say that any effort at this time toward the standardization of tool steel specifications by any buyer or organization is detrimental to the best interests of all. Because of the wide range in composition the satisfactory substitution of one alloy for another, the detrimental effects of small amounts of many elements, the inclusion of oxides and dirt, and the effects of grain size and structure, no purchaser can draw up a specification that would meet commercial practice that would fully protect him from obtaining an undesirable tool steel.

The purchaser's best protection is the brand name, as it is the quality mark of the manufacturer. The deserved reputation of a brand is highly prized by the maker and he will in no way jeopardize that reputation by selling an inferior product under that brand name. No industry has been more free in the employment of technical skill than the tool steel manufacturers, yet the making of tool steel is still an art, and this is as true today as it was in the time not long ago when the secrets of the trade were handed down from father to son.

They conclude with the statement that the chief ingredient in tool steel is the honesty and integrity of the maker.—*Transactions of the American Society for Steel Treating*, Jan., 1926, p. 75.

Assembly by Welding

L. S. Love discusses the assembly of stampings by welding processes. With research in the electrical field came the development of arc welding and the butt, spot and seam welding processes, working on the resistance principle. Refinement of apparatus for using acetylene or other gas and oil fuels brought the use of intense direct heat to fuse metal from a welding wire to two or more pieces to be joined. With all of these later methods of welding it has been only in comparatively recent years that actual progress has been made in their use on other than the simplest forms of work, first in making repairs, later as parts of manufacturing processes.

In addition to the development of welding equipment, a factor of importance in the production of difficult stamped and welded assemblies is the extensive use of jigs for holding pieces to be welded. The jigs not only facilitate rapid production in welding, but also are so made as to be fool-proof, counteracting to a large extent the human tendency toward error and they permit of holding the finished piece to close limits of accuracy.

On some products it has been found desirable to defer final assembly until the work reaches destination, because of easier or less costly transportation of pieces when shipped knocked down. In such cases the customer has been tooled to effect the final assembly in a welding jig or when welded assemblies are to be bolted together they are so designed as to require a minimum number of bolts.—*The Iron Age*, Jan. 14, p. 123.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

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Changing Shop Equipment

WHEN a shop has quite a line-up of machines of any certain make, it isn't an easy matter for a new-comer to break in with a different machine. And it isn't all prejudice—there are plenty of sound reasons for not making a change unless the new machine has many advantages.

With a battery of any good screw machines, for example, the manager must consider the effects of putting in machines of different make. The men understand the machines they are now using, and a change causes some confusion. The number of spare parts must be increased and the work- and tool-holding devices on hand will not fit the new machines. It takes, therefore, decided advantages in production to make a change advisable.

It would be much easier to make a change if the tool- and work-holding devices could be used on both machines. If this were possible the new machine would get an opportunity of showing its merits where it is now very difficult. Standardization of such parts would make a change much easier to accomplish.

Where Schools Can Help

THE need of a new and larger crop of mechanics is becoming apparent to all who are in contact with the mechanical industries. The problem is how they are to be secured. There seems to be doubt as to the old methods of apprenticeship being applicable in all cases and yet the feeling that the final training must be done by the individual shop.

This seems to point to a combination of school and shop training, such as has been tried in many cities and with varying success. The possibilities of some such plan are being considered by the manufacturers of Cleveland under the leadership of Dr. Vincent of the Western Reserve University in the hope of working out a plan whereby the educational facilities of the city may become of even greater value to all concerned.

There seems to be a pretty general agreement that the final training must be had in the shop on real work and under actual manufacturing conditions. On the other hand there is a growing feeling that a preliminary training during which the boy or man becomes somewhat familiar with the handling of machines and with the fundamentals of shop work, can be done more economically in a school shop.

The development of this plan will be of general interest and the results are promising.

Simplifying Wire Gages

THE Society of Automotive Engineers has asked the American Engineering Standards Committee to take up the unification of methods of designating the thickness of wire and metal sheets and plates. The problem is to be submitted to all the industrial groups by the A.E.S.C and the Division of Simplified Practice of the Department of Commerce.

A simplification of the present wire and sheet gage situation will go far in eliminating misunderstandings and in saving both time and money. There are now thirteen gages that are used and can be called for, two of them bearing the name of Stub's.

This seems like an excellent opportunity to urge the abolition of all wire and sheet gages and to urge that both wire and sheet be designated in thousandths of an inch. If one wants to use numbers, it can then be done without confusion by having the number designate the thousandths of an inch wanted. Number 300 would be 300 thousandths or 0.300 in. and any other number would be read in the same way.

Objection may be raised to the even thousandths as a number of the present tables go to four decimal places. But if an even thousandth is not fine enough, the size can be readily designated by decimals and eliminate all chance of errors. There is considerable sentiment in favor of designating dimensions by decimals and by so doing, much mental wear and tear are sure to be saved.

Just Suppose

JUST suppose that every office had a comfortable waiting room for callers. That in every one a man could at least sit down. That when he sat he would not be right against a red-hot radiator, or a window open to the chilly winds. That he didn't have such a thing as a shelf poking into the back of his neck. That he didn't have to hold his brief case and his overcoat and his hat in his lap.

Only people who are trying to sell us something, you say? Well, once in a while a buyer has to wait. And then every so often doesn't a salesman do a whole lot for you when he sells you something? And occasionally doesn't some one stop in who gives you something? Anyway, isn't it worth while to make people comfortable just for the sake of doing it?

Just suppose.

Shop Equipment News

National High-Duty Forging Machine

The National Machinery Co., Tiffin, Ohio, has made improvements in its line of forging machines and increased their capacity, weight and speed of operation for high-duty service. The essential features of the earlier models, one of which was described on page 542, Vol. 39, of the *American Machinist*, have been retained. These include the short and compact underslung bed frame, the suspended-type heading and gripping slides, the patented automatic grip relief, the wedge-type liner adjustments for the heading and gripping slides and the friction-slip flywheel.

The bed frames have been increased in depth and weight and are constructed in the form of a heavy C-clamp to secure rigidity and to prevent a springing open of the bed frame. It is claimed that the construction prevents swollen shanks and excessive fins on the forgings and practically eliminates the necessity for back stops. It is said also to make unnecessary the use of tie rods.

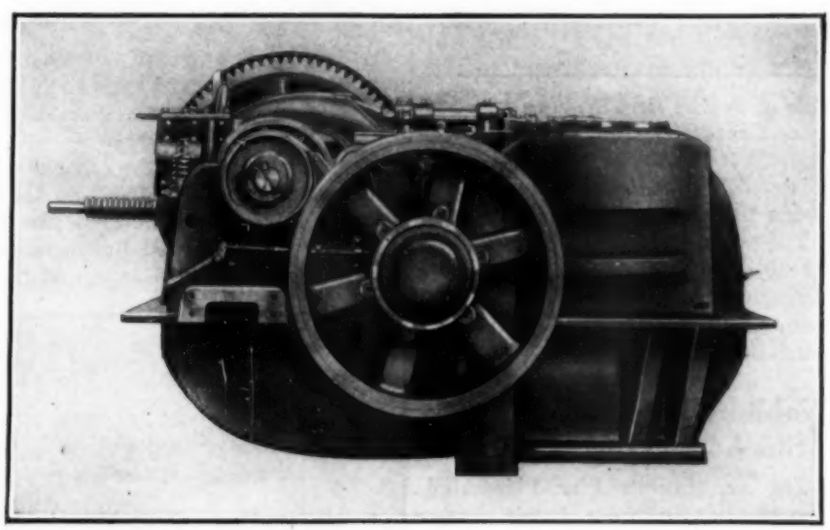

Fig. 1—National High-Duty Forging Machine

In Fig. 1 is shown a view of the flywheel side of the machine. The compactness of design is made possible by means of the adoption of the over-arm type of heading slide which has only part of its necessary length at the customary location ahead of the crankshaft. Fig. 2 shows the construction of the over-arm of the heading slide. This over-arm is an extended bearing which serves to increase the accuracy of the slide alignment. The grip slide is also shown in Fig. 2. It is provided with an extended under-arm to prevent both sagging and rocking of the slide. By maintaining uniformity of grip slide alignment, the grip dies can be made to clamp the work through its entire length. This lessens the chances for the work to slip. The alignment features are said to permit much work to be machine-forged where it was formerly necessary to use more expensive methods or to do it on a drop hammer. It may also be seen in Fig. 2 that the knuckle block at the front end of the heading crank pitman has been replaced by two bronze-bushed bearings in the cheeks of the heading slide, which operate in connection with a large round pin gripped in the front of the heading pitman. This design has increased the bearing area and avoids the trouble caused by scale and dirt getting into the knuckle bearing.

Among other improvements in the machine is an increase in the depth of die space. This increase has been made entirely below a center line passing through the crankshaft. The construction makes possible the use of higher dies than previously without giving the heading slide a tendency to rise out of its bearings. A tendency for the heading slide to rise is also avoided since the great length of the heading slide enables the downward pressure from the heading crank pitman to hold the front end of the slide in a downward position in resistance to the tendency of the slide to raise when the work is above the center line. The machines are equipped with the usual suspended-type heading and grip slide bearings designed by the company. The bearing surfaces are placed above the path of scale and water and they have the wedge adjustment at the sides of the slides so that by removing the top cap of the bearing any side play can be adjusted without the necessity of removing the slide from the machine.

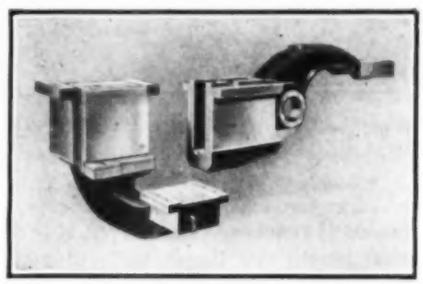

Fig. 2—The heading and gripping slides with extended arms

The improved forging machines are equipped with the quadruple-abutment starting clutch illustrated in Fig. 3. This allows the machine to be started in one-quarter of a revolution and increases the production of the machine. A clutch dog or pin rides in a slot in the shaft, shown in Fig. 4, and is held out by a spring plunger. It is prevented from entering the driving recesses in the flywheel by an actuating finger which normally keeps the dog depressed so that the flywheel rotates free. When the finger is withdrawn, the dog is pushed outward by means of the spring and engages in the first

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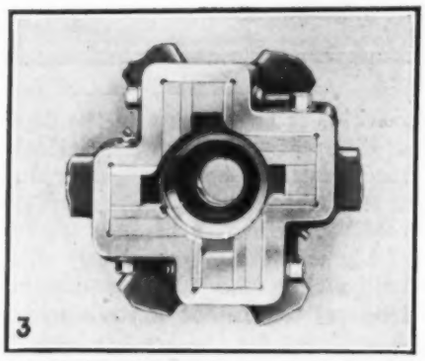


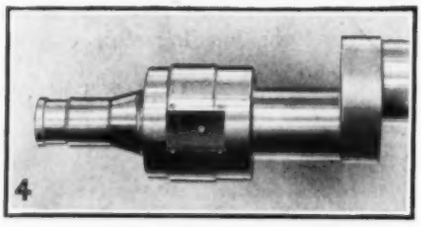


Fig. 3—The quadruple clutch mechanism. Fig 4—The drive shaft showing seat for clutch pin

recess it reaches. The driven side of the recess is lined with flexible laminations to absorb part of the starting shock. These laminations are shown in Fig. 3 behind the hardened steel abutment blocks of the four recesses. The driving pin is of large size to insure its freedom from the necessity of undergoing frequent repair or replacement.

The machines are built in sizes of 2, 3, 4, 5 and 7½ in. and are supplied for either belt or direct, geared motor drive. A friction-slip flywheel is supplied as a safe-guard to the motor.

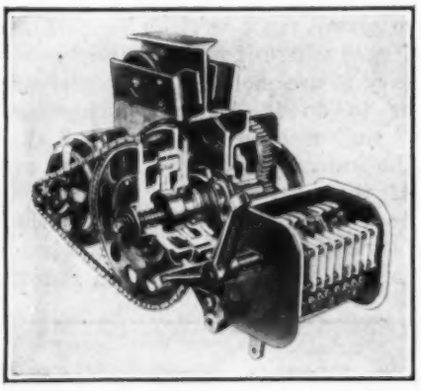
Yale & Towne Ball Bearing Electric Chain Hoist Model 20B

The Yale & Towne Manufacturing Co., Stamford, Conn., has developed its model 20B ball bearing electric chain hoist. It has been designed to provide for close head room, long lift, increased speed, automatic top and bottom limit stops and for greater over-all strength than the former models built by the company.

The suspension members of the hoist are of steel. It is provided with an electrically welded steel chain that is made by the company and which can be furnished for varying lengths of lift. The suspension is centralized to secure a balanced load on the trolley wheels and the hoisting unit.

The hoist mechanism is fully inclosed in oil-tight chambers and is compact and easily accessible for inspection. A ball-bearing load sheave is provided to secure lower current consumption and greater efficiency. Chrome-vanadium steel balls are used around the sheave. It is of one-piece construction and is ground on an arbor to insure concentricity with the ball races. It is bronze bushed for the driving pinion. The driving pinion passing through the load sheave is machined from a single drop forging and heat-treated. All pinions, gears and bearings are splash lubricated.

Steel chain containers can be furnished to hold any length of slack chain up to 60 ft. for the ¼-, ½- and 1-ton hoists, and 30 ft. for the 2-ton



Yale & Towne Ball Bearing Electric Chain Hoist, Model 20B

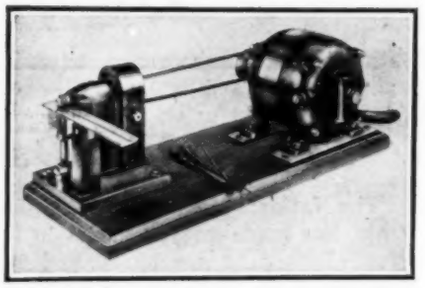
hoists. These containers are secured to the under-frame of the hoist.

The model 20B is adaptable to different overhead systems. The side plates of the trolley carriage can be spaced on steel bars to fit the desired beam flange.

Noble & Westbrook Strip-Stock Marking Machine

The marking machine illustrated is made by the Noble & Westbrook Manufacturing Co., 19 Asylum St., Hartford, Conn., especially for the marking of gold solder with a continuous mark that designates the grade of the solder.

The machine is similar in construction to the hand-operated model previously described on page 36, Vol. 63, of the *American Machinist*.



Noble & Westbrook Strip-Stock Marking Machine

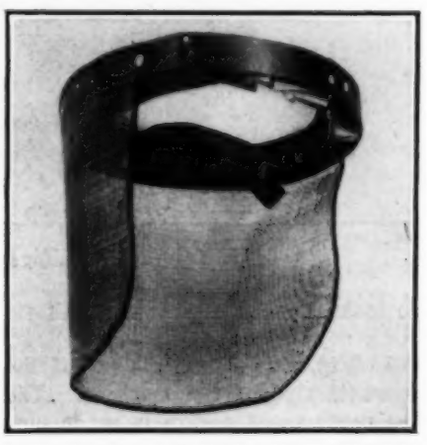
Instead of the hand crank operated through gears, a ¼-hp. motor, driving through a worm gear and a V-pulley is used.

The solder is fed between the rolls, the top one of which is lettered and the bottom one of which is grooved to carry the stock. Provision is made for carrying different thicknesses of material. The machine runs continuously as the stock is fed into it. The weight, including the motor, is about 30 pounds.

Sherman Head Mask for Forge Shops

The head mask shown in the accompanying illustration has been designed by the Sherman Corporation, 2 Rector St., New York, N. Y., for use in forge shops where the spray of chips, sparks and bits of slag is not entirely downward as is the case in welding, but in all directions, especially toward the face.

For convenience, the mask is equipped with a head-band so that it can be put on or removed like a hat. It is not fastened, but depends for its support on an elastic and the



Sherman Head Mask for Forge Shops

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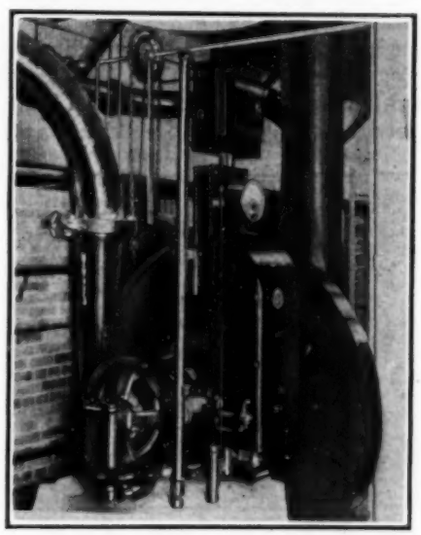
adjustable tape of the head-band. The distance of the wire mesh from the eyes is such that it will give good visibility without fatigue.

A fabric rim is provided around the wire meshing so that there will be no jagged edges in contact with the face of the operator wearing it or to catch in the operator's clothing.

General Electric Centrifugal Air Compressor

The centrifugal compressor illustrated is manufactured by the General Electric Co., Schenectady, N. Y., for supplying air to oil-burning furnaces. It is designed to deliver 1,800 cu.ft. of air per min. to the furnace



General Electric Centrifugal Air Compressor

at a pressure of 1½ lb. per sq.in. It operates at a speed of 3,450 r.p.m. and is directly connected to a 20-hp., 3-phase, 220-volt, 3,600-r.p.m. induction motor.

The motor is controlled by means of a General Electric hand compensator to bring the compressor quickly up to speed. A special calibrated scale on the ammeter reads in amperes and in cu.ft. of air per min., so that the current input and the quantity of air delivered can be quickly seen.

The desired volume of air to be delivered can be secured by adjusting the blast gate in the air line. This can be regulated until the desired volume of air is indicated on the meter.

Betts Locomotive-Frame Slotting Machine

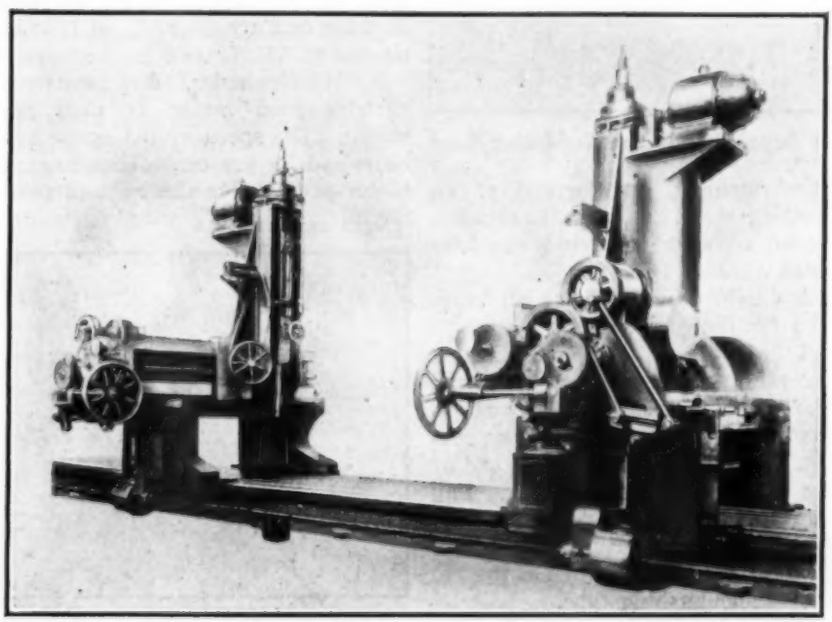
An improvement in the design of its locomotive-frame slotting machines has been made by the Betts Works of the Consolidated Machine Tool Corporation, Rochester, N. Y. The illustration shows one of these machines equipped with two heads but they are furnished with one, two or three heads, as desired.

Advantage has been taken of the electric means for driving, feeding and traversing so as to simplify the motions over the mechanical methods. The bed consists of a wide, deep casting with long, narrow guiding surfaces for yokes. The faces on which the yokes bear are chilled to secure a hard smooth surface. The top is provided with suitable T-slots for clamping the work. Both sides of the bed are equipped with stationary leadscrews, revolving nuts which engage with them being used to move the yokes.

Each yoke has a separate electric feed and power rapid traverse along the bed. A single driving motor is mounted on each yoke. The yokes have fine hand adjustments through large handwheel within reach of the floor. The cross-rails are arranged with either hand or power swiveling movement for angular slotting. Each saddle has electric feed and power rapid traverse. Hand adjustment is provided along the cross-rail. The motor that furnishes the driving feed and power rapid traverse to the yoke performs the same functions for the saddles. Both the yoke and the saddle feed may be engaged simultaneously for angular slotting. The feed is adjusted by means of graduated feed plates located conveniently for the operator and accessible from the floor. Independent feed to the yoke and saddle is provided.

Each ram is driven by means of a 20-hp. reversing motor that has a high return speed ratio. The cutting and return speeds are independently adjustable by means of separate rheostats for each. The rheostats have wide ranges of speed. Push button control is available for starting, stopping, reversing and inching all motors.

The rams are counterbalanced by means of sliding weights suspended from steel cables. They are entirely self-contained. The mechanism is driven through spiral-bevel gears that drive a rotating screw meshing with a bronze nut which has provision for the taking up of wear. A mechanical knockout device is provided to prevent over-travel. The length of the stroke is adjustable by means of dogs which operate a master switch controlling the motor connected to each slotting ram.



Betts Locomotive-Frame Slotting Machine

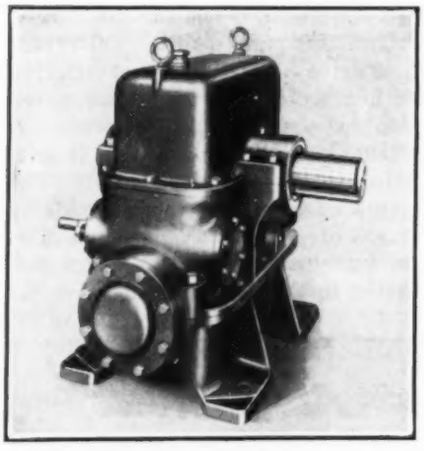
Shop Equipment News

Lubrication is supplied to all bearings, the saddle bearings being supplied from an automatic pump with feeder pipes to each.

The width between yokes, the height under the yokes, the length of the beds and the travel of the slotting rams are made to the customer's specifications. The height and the length of the stroke is arranged to permit the slotting of frames in multiple.

De Laval Two-Worm Reduction Gear

A two-step worm reduction gear has been developed by the De Laval Steam Turbine Co., Trenton, N. J., to provide ratios of from 100 to 1 to 8,000 to 1. The unit which is illustrated is designed for driving cooling tables, conveyors, stokers, heat-treating furnaces, escalators or similar devices. The gearing consists of an initial worm turning a



De Laval Two-Worm Reduction Gear

wheel mounted on the end of an abutting shaft. This shaft carries a second worm which drives the low-speed wheel and shaft.

A single casing carries all bearings for the high-speed worm shaft and the low-speed worm shaft, which also carries the high-speed wheel and shaft so as to insure accurate alignment and meshing. The construction is rugged to enable the use of the unit for heavy-duty work. End thrust and bending strains from the driving and the driven machine are taken on flexible couplings of the pin and rubber bushing type.

The casing serves as an oil reservoir. The oil is maintained at a sufficient level to touch the high-speed wheel and the low-speed worm at all times.

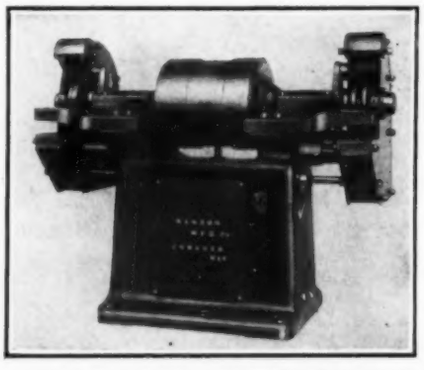
In addition to this, the unit is equipped with a positive oil pump by means of which oil is drawn from the reservoir and forced through passages to the low speed shaft bearings. Suitable filling and draining openings and oil cocks are provided for controlling the oil level. A packing gland prevents the escape of lubrication along the high speed worm shaft, while an oil slinger working between the end of the low-speed shaft bearing and an oil guard, and held in grooves in the casing and cover, prevents seepage along the low-speed shaft.

Ransom Direct-Motor-Drive Grinders

The Ransom Manufacturing Co., Oshkosh, Wis., has brought out the direct motor-driven grinding machine illustrated. It was designed primarily for use in the automobile industry, but it can be used equally well as a production grinder in other industries.

The machine will accommodate 20x2-in. wheels on each end, which are provided with guards made from steel plates riveted together. Each end of the grinder is equipped with a heavy work support. The shafts run in long sleeve bearings made from lumen metal. They are removable and can be replaced if it is necessary.

A Westinghouse, direct-current, variable-speed motor is used for power. The speed of the motor can be raised 75 per cent above normal to compensate for the reduced peripheral speed of worn grinding wheels. The motor is not totally inclosed, but is provided with a slight ventilation sufficient to avoid excessive heat when the grinder is subjected to continuous use during production.

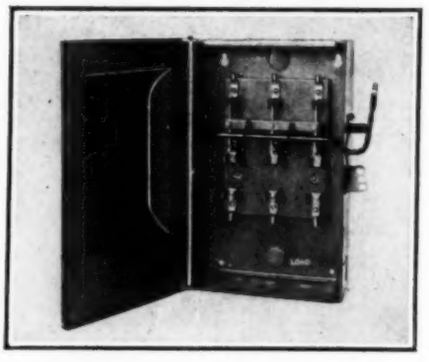


Ransom Direct-Motor-Drive Grinder

An automatic accelerating starter supplied by the Electric Controller and Manufacturing Co. is used for the motor. The starter is push-button controlled. The weight of the machine is 2,000 pounds.

Westinghouse Quick-Break Industrial Switch Type WK-62

The type WK-62 quick-break, industrial safety switch, illustrated, has been brought out by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. The switch is externally operated and totally inclosed for industrial and other applications where a disconnect switch is desired.



Westinghouse Quick-Break Industrial Switch, Type WK-62

The stops that limit the travel of the switch arm and the blades are placed on the outside of the box to simplify construction and to afford additional room for wiring. Knock-out disks are provided in the back, sides, top and bottom of the box for any desired arrangement of the conduit. The diamond pointed jaw and the extended blade are used in this model so that any burning that occurs when the switch is opened does not foul the current-carrying area of the blades and break the jaws.

The switch is supplied in capacities of from 30 to 200 amp. and is rated at 250 volts d.c. or 250 to 500 volts, a.c. in both fusible and non-fusible types.

News of the Week

President of Canadian National Railways Indorses Co-operation Plan

Sir Henry Worth Thornton considers interest of management and unions identical

Co-operation between management and labor is a solution of many of the perplexing problems of the railway industry, according to Sir Henry Worth Thornton, chairman of the board of directors and president of the Canadian National Railways.

Sir Henry addressed a meeting of engineers and managers Feb. 5, in New York, under the auspices of the Taylor Society and the Metropolitan Section of the American Society of Mechanical Engineers, with several other societies co-operating. The other speakers were Otto S. Beyer, Jr., consulting engineer, who explained the technique of the plan that has been adopted by several railroads; and Bert M. Jewell, president of the Railway Employees Department of the American Federation of Labor, whose statements constituted labor's appraisal of the principles, methods and results. The general subject of the session was "Union-Management Co-operation in the Railway Industry," and was a case presentation of the effect toward stabilization that has been going on for the past two years.

The three papers comprised the first authoritative public statement of the attitudes of management and labor on union-management co-operation in the railway industry. This plan is now in effect on the Baltimore & Ohio, Canadian National Railways, Chicago and Northwestern and the Chesapeake & Ohio, four Class I railways, the total mileage of which is 20,000. These roads have 45,000 employees.

Mr. Beyer explained that the life of the plan depends upon seven basic requirements. They are full and cordial recognition of the standard unions as the properly accredited agents to represent railroad employees with management; acceptance by management of the standard unions as helpful, necessary and constructive in the conduct of the railway industry developing between unions and management of written agreements governing wages, working conditions and the prompt and orderly adjustment of disputes; systematic co-operation between unions and management for improved railroad service and elimination of waste; stabilization of employment; measuring, visualizing and sharing fairly the gains of co-operation; and perfection of definite joint union-management administrative machinery to promote co-operative effort.

It was stated by Mr. Beyer that the Baltimore & Ohio, because of the plan, has greatly increased its revenues and practically eliminated contention between management and labor.

Mr. Jewell, who supported the plan when it was inaugurated and extended the co-operation of his men, announced his satisfaction with the results and pledged his group to its continuance.

Sir Henry Thornton said in part, "Union-management and co-operation in the railway industry seeks to achieve as a primary objective continuity of employment and in the accomplishment of this objective is destined to play a great and useful part. It already has been applied to shop work and if successful I can see no reason why it should not be equally applied to other industries.

"The most fearsome thing in the life of the laboring man is the lack of knowledge that his job is secure from day to day and that his family will be as surely cared for a year from now as now. This is the heart of the plan. It will insure to capable, willing workmen continuity of employment. The only present problem is adapting the plan as tried in the shops to the whole line of the industry."

Adjourn Metric Hearings to Summon Leading Manufacturers

Voluminous testimony has been taken by the Coinage, Weights and Measures Committee of the House of Representatives in support of Representative Britten's bill providing for the compulsory use of the metric system for certain purposes, on and after Jan. 1, 1935. Numerous witnesses were introduced including Dr. Harvey W. Wiley, former chief of the Bureau of Chemistry; Dr. Charles L. Parsons, secretary of the American Chemical Society; Representative Britten, author of the bill and Frederick L. Roberts, treasurer of the Metric Association.

At the request of those opposed to the bill the hearings were adjourned until a date to be fixed hereafter so as to give opportunity to summon manufacturers and others who have to deal continuously with weights and measures in the conduct of import businesses.

Brief statements in opposition to the bill were made by C. C. Stutz, of the American Institute of Weights and Measures, and by Samuel S. Dale, of Boston, former editor of a textile publication. They explained that their object simply was to acquaint members of the committee with the widespread character of the opposition.

In concluding his testimony Representative Britten quoted General Pershing as follows: "The experience of the American Expeditionary Forces in France showed that Americans were able to change readily from our existing system of weights and measures to the metric system." Commenting on that Mr. Britten said: "That is a very important point in favor of the metric system. When it comes to making calculations from the air all a man, sitting in an airplane, has to do is to put a decimal point right where he wants it. He could run it down to almost a millionth part of an inch. It could be done instantly. You cannot do that with our present system." The opposition does not expect to have great difficulty in establishing the impracticability of that contention.

At another point in his testimony Mr. Britten in an effort to explain the simplicity of the metric system proposed that if a fifty-seventh part of the world yard were required, all you have to do is to put down fifty-seven and then put a decimal point in front of it. As a matter of fact that fifty-seventh part of a meter is 17.5614 centimeters.

Mr. Britten explained that much of the opposition to metric legislation had come from farmers who object to changing acres to hectares. For that reason he explained the bill exempts all land measures.

Representative Fitzgerald, of Ohio, after hearing Mr. Britten's testimony and before any witness in opposition had appeared, declared that he would vote "first, last and all the time" for a favorable report on the bill.

During the hearing it was admitted that the bill before the committee is intended only as an entering wedge, as in the natural course it would be followed by legislation putting the metric system more generally into effect.

Boye & Emmes Will Rebuild Factory

Announcement has been made by officers of the Boye & Emmes Machine Tool Co., of Cincinnati, that the plant on Queen City Ave. and Buck St., in that city, would be rebuilt at once. The factory, with the entire equipment, was completely destroyed by fire on Jan. 27. Already the work of clearing away the debris has been started and construction will begin immediately.

The fire, which started from unknown causes early in the morning, was confined to the machine shops. The general offices and pattern shops of the company in nearby buildings were not touched by the flames.

Machinery Export Ratio Lower Last Year

In a general way, it has been recognized that American machinery manufacturers export perhaps 20 per cent of their production, while British and European manufacturers generally export a much larger proportion. Ratios of this character necessarily fluctuate very widely from year to year, and certain returns have recently been made available by the Bureau of the Census.

According to the census, industrial machinery production in the United States in 1923 was $1,403,688,000, while the export statistics for that year show that the total shipped abroad was only $123,598,000, giving an export ratio for the entire American machinery industry of only 8.8 per cent.

The corresponding experience of 1921 was radically different, for the census of that year shows a production of $901,087,000, of which exports represented $208,798,000, revealing an export ratio of 23.2 per cent.

The decline in exports from 23.2 per cent to 8.8 per cent is rather startling until it is remembered that during 1921 industry in the United States was suffering from depression while the export trade still felt the stimulating influence of the post-armistice boom, which at that time, had not entirely spent its force. In 1923, the reverse situation prevailed, for export business was exceedingly dull and machinery shipments abroad showed a volume of less than 60 per cent of that of 1921; meanwhile production had expanded, because of domestic demand, showing an increase in excess of 55 per cent.

This striking change in the conditions emphasizes the need of discretion in any discussion relating to the export ratios that might be expected in any particular branch of the machinery industry.

The collapse of the export ratio for oil-well machinery from 41.2 per cent to 12.7 per cent is, perhaps, the most striking change revealed. There was some improvement, however, in mining machinery, for although the export ratio was shaded slightly, the volume of equipment shipped increased 34 per cent in the face of the falling tendency in the general machinery market. Refrigerating equipment and cotton gins also made a very creditable showing.

Auto Production in France Increased Last Year

With a production estimated at 205,000 passenger cars and trucks, the French automobile industry experienced its most successful year in 1925, according to assistant trade commissioner H. H. Kelly. Production increased approximately 55,000 units, or 37 per cent over 1924, and both domestic sales and exports rose in proportion.

No official statistics have been announced for the production of the French industry, and all figures are estimates.

It is significant of the French industry that three firms, one of them being an American assembling company, accounted for 137,500 units, or 67 per cent of the total. Nine others produced 38,800 or 19 per cent. Since there are about 90 producing automobile firms in France, the balance of the total production, or 28,700 cars and trucks, was distributed among 78 companies.

British Markets Buy Most American Machine Tools

The British market for industrial machinery during 1925 improved over 1924, owing principally to better trade in the automobile, aeroplane, and electrical goods industries, and in railway shop equipment and construction machinery. Plant extensions in most of these lines have called for additional supplies of plant equipment, such as heavy machinery, as well as machine tools, while the increase in building throughout the country has stimulated sales for construction machinery. Extensive building of new roads, and the reconstruction and repair of existing roads made important progress during the year, with a consequent increasing demand for road-making equipment. No statistics covering British production are as yet available, but several important orders for equipping foreign plants were received by British firms, which, together with the increased domestic demand for plant equipment, indicate that production has been well above the previous year, or the past three or four years.

The export returns show an increased demand in foreign countries made upon British machinery manufacturers for the first 11 months of 1925. The import statistics now available for the 11 months ended November, 1925, reflect improvement in the market, 66,730 tons of all kinds of machinery, valued at £10,720,452 having been imported.

Most of the heavy machinery, such as rolling mills, shears, presses, hammers (both steam and pneumatic), cutters, and dies used in British plant equipment, is domestically manufactured. The same is true of heavy machine tools, such as large planing mills. There is, therefore, little or no import trade in these commodities.

Construction machinery in Great Britain, such as saws, shears, punching, drilling and riveting machines (both hydraulic and pneumatic), is also supplied mainly by domestic producers, although there is some American equipment in use.

Imports of machine tools for the 11 months, January to November, 1925, totaled 4,558 tons compared with 3,007 tons for the same period in 1924—an increase of 50 per cent. British exports of machine tools, January to November, 1925, totaled 12,854 tons, as against 10,955 tons for the same period of 1924, an increase of 17 per cent.

The United States held an outstanding position as a supplier of machine tools for the British market, furnishing imports for the period of January to October, 1925, inclusive, a total value of £376,285—more than twice as much as that supplied by its nearest competitor, Germany.

Farm Machinery Exports Ahead of Previous Year

Exports of agricultural implements from the United States for the first 11 months of 1925 reached a total of $70,460,761, according to the agricultural implements division of the Department of Commerce. This is approximately $12,000,000 greater than the exports during the first 11 months of 1924, and is $8,000,000 greater than the exports during the calendar year 1924. The 1925 exports, which are for 11 months only, are greater than the exports in any preceding total calendar year, with the exception of 1920, when exports amounted to $80,000,000.

Argentina has continued the lead which it assumed in 1924 in purchasing American implements, and in other South American countries there has generally been a more active demand than in 1924. The demand in Cuba has been somewhat below normal, due to various unfavorable economic conditions, but with this exception the sales of American implements have been quite good throughout most of the Western hemisphere.

Among European countries, Russia has renewed its purchases of American implements on an important scale. The implement business in France has been good throughout most of the year, but a great deal of the business has gone to domestic manufacturers, with a resulting decrease in purchases of American implements. Some of this decrease may perhaps be attributed to the implements which were furnished by Germany by way of reparations. Otherwise, there have been no outstanding changes in the European market.

More than one-third of the exports of implements during the first 11 months of 1925 consisted of wheel tractors, of which 40,879 valued at $23,597,080, were exported. This is almost double the number and value of wheel tractors exported in the same period of 1924. The second largest item exported consisted of plows, valued at more than $6,500,000. Next came harvesters and binders, which exceed $5,000,000, while exports of mowers were in excess of $2,000,000, and shipments of harrows, cultivators, and drills and seeders, etc., exceeded $1,000,000.

Committee to Enforce Code of Ethics

As an executive body charged with the carrying out of the provisions of the Code of Ethics adopted by the National Machine Tool Builders' Association, H. M. Lucas, president of the association, has appointed the following members to a committee on trade practices: W. A. Viall, the Brown & Sharpe Manufacturing Co., chairman; A. H. Tuechter, the Cincinnati-Bickford Tool Co.; O. B. Iles, the International Machine Tool Co.; James E. Gleason, the Gleason Works; J. G. Benedict, the Landis Machine Co.

This committee will receive complaints of members if the code is violated, will hold hearings on these complaints and issue judgment relative to them.

British Trade Experts Predict Supremacy of United States in World Commerce

Interesting observations comment on general prosperity

Greatly increased production efficiency, stability of commodity prices and amazing general prosperity were chief among the impressions reported by Col. F. Vernon Willey and Guy Locock during their recent visit to the United States as representatives of the Federation of British Industries. In their report, which is on file with the Merchants Association of New York, the visitors freely predicted an early participation of the United States in world trade on a scale that would seriously threaten the supremacy of Great Britain in many quarters. This prophecy is based on America's remarkable production organization, sound financial position and demonstrated business initiative.

Safe Limit Reached

After reviewing general industrial conditions, which were deemed to be entirely satisfactory, the report touches on American production, the conclusions being that physical expansion of manufacturing facilities had reached a safe limit, and that further construction will be limited to domestic housing. Touching on this point, the report says, "The era of intensive factory construction is over, as is evidenced by the proportion of industrial as compared with private building. In 1920 industrial building was 23 per cent of the total building activity, while residential building accounted for only 22 per cent. In 1923 the figures were: Industrial building 10.8 per cent, residential building 45.1 per cent. This shows clearly that new industrial construction has fallen down and that the bulk of the present day building is due to the prosperity of the individual and the rapid increase in house ownership. While it is thus clear that the rate of increase of production and capacity has diminished, we must remember that the present maximum capacity is enormous and that there is certainly 20 per cent and possibly 25 per cent margin for expansion, and also that there is a nation-wide striving for efficiency and improved methods of utilizing existing plant and keeping it up to date."

Refer to Land Booms

Turning to the financial situation in industry, the report states "Certainly there has been an immense appreciation in capital values, and with the large amount of spare capital available, capital values are likely to be maintained. This capital appreciation has, however, undoubtedly faced American industry and commerce with the problem of how to maintain an adequate return on present capital values, and this is a very powerful incentive to increase efficiency. Secondly, there has recently been a series of land booms and a boom of the first magnitude is occurring in Florida today, where enormous profits are being made.

"The inflation of capital values and the Florida land speculation contain elements of danger, and a reaction must obviously set in. It is, however, important to realize that the present investment and speculation activity is not being financed to any large extent by the banks, but represents the investment of private money, and the utilization of the rapidly growing reserve of individuals."

Stability of Prices

An interesting observation by the visitors was that in the face of general prosperity, prices had failed to rise. "Normally one would have expected that the enormous influx of gold into the United States would have tended to raise prices substantially by forming the basis of credit expansion, and that the undoubted strength of the demand for commodities would have operated in the same direction. This, however, has not been the case, and American prices have not risen as anticipated. During the last two years there has been a spirit abroad, among the consuming public in the United States, which is often referred to as 'the consumer's strike.' In other words, the producer has been unable to raise his prices, because if he did so, he would not sell his products. The failure of American prices to rise as predicted is all the more remarkable in view of the enormous expansion of the deferred payment system."

Efficiency Increased

Regarding increased production efficiency, it is important to note this observation: "In the last ten years the volume of railway freight has increased by 25 per cent, while the number of employees has remained stationary. Equally striking is the position in agriculture, where it is estimated that in the last decade the number of farmers on the land has decreased by 2 per cent, while the volume of production has been increased by 25 per cent." The reasons generally attributed to this increase in efficiency are (1) increase in general and especial education, (2) restriction of immigration, (3) high wages, (4) unrestricted output and utilization of labor saving devices, and (5) satisfactory relations between employers and employed.

Unequaled Attainments

Regarding our industrial organization, the report credits the United States with attainments never equaled in any other country, with the possible exception of Germany. This is explained as follows: "In individual businesses the tendency is toward the larger unit, and this tendency is likely to become more and more marked. Apart from this movement toward amalgamation, there is far more readiness in America that in Great Britain for the different firms in one industry to co-operate for their mutual good, and even to go so far as to pool a great deal of their technical and business experience. The American convention habit may be somewhat overdone and may appear to consume a great deal of time, but there is no doubt that the habit of meeting together frequently and exchanging experiences has proved of great value to American industry."

Would Repeal Rates on Metal Schedule

A resolution introduced into the House of Representatives on Feb. 1 by Congressman Hull, of Tennessee, provides for the holding of public hearings and investigations with a view to preparing a bill to repeal some of the existing duties in Schedule 3 of the Tariff Act of 1922.

This is known as the iron and steel or metal schedule, and many of the duties embodied therein are considered useless both from the standpoint of revenue and appreciable competition. It is proposed to reduce to a moderate or competitive basis for revenue such duties as are either excessive or prohibitive.

Wagner Electric Motor Wins Honor

The Wagner Electric Co., of St. Louis, has been awarded the John Price Wetherill Medal by the Franklin Institute, "with special mention of Val. A. Fynn and Hans Weichsel, in consideration of the progress in the electric art which this invention marks, and of the development of a motor of excellent design and construction."

The description of the Fynn-Weichsel motor, as presented by the committee on science and the arts of the institute, and as recorded in the "Journal of the Franklin Institute" for December, 1925, states that:

"This machine is a synchronous-induction motor, either two- or three-phase, having an automatic, self-generated, direct current to obtain the synchronous speed but with characteristics quite different from the ordinary synchronous motor. It may be used to produce mechanical power at unity power factor, or it may produce power and also raise the power factor of other motors in the same installation."

Historic Auto Data Presented to Chamber

Alfred O. Dunk, president of the Puritan Autoparts Co., of Detroit, has presented to the National Automobile Chamber of Commerce all the original tracings, drawings, blueprints and United States and foreign patents which were the property of some 756 automobile plants which have gone out of existence.

These tracings and patents are given to the National Automobile Chamber of Commerce for the benefit of automobile manufacturers of the country for reference purposes. They cover cars from the Mobile, Aero Car, Carter Car, Welch, Lozier, Alco and other auto companies.

R. A. Branigan, manager of the chamber's patent department, has arranged filing space for ready reference to these drawings.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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IRENEE DU PONT, president of the great du Pont de Nemours Co. at Wilmington, Del., was quoted last week as saying the only cloud upon the 1926 business horizon was excessive land speculation.

In this view a great majority of American business men probably will agree, and it is quite natural that the various land booms throughout the country should be carefully watched. Thus far it cannot be said that any of them have collapsed, but it is undoubtedly true that buyers are becoming more circumspect, and from the lavishness with which the real estate people are advertising it is to be inferred that the eagerness of sellers is increasing.

The widespread speculation in land has been so much talked about that its relative importance probably has been exaggerated, and the effect of an effort to liquidate might be more sensational than the facts warrant. For this reason it would be well not to give undue weight to the various rumors that land boomers are trying to get out from under.

It is undoubtedly true that much of the property that has recently changed hands was sold at prices that were unwarrantably high, but the money invested in these ventures has already been paid out and in so far as it may represent an ultimate loss it is already gone and cannot be lost a second time. As there has been no destruction of property the community as a whole will be no poorer, although its land may be appraised at lower figures.

This aspect of the situation is emphasized in an effort to minimize the effect of the reaction in the realty market that so many are now predicting. The outlook otherwise seems tranquil, and upon the whole reassuring.

Speculation on the Stock Exchange was held in check during the week by the fear that the statement of brokers' loans to be published after the close of the market on Saturday would show aggregate borrowings somewhat in excess of earlier anticipations.

The total as published is $3,513,000,000. This is larger than had been expected, but the fact that 71 per cent of the amount is borrowed on call is even more surprising. It is possible that the fear of some action by the Stock Exchange was reflected by the higher rate demanded for call money, which advanced on Thursday. The time rate does not reveal any scarcity of credit and the weekly statement of the Federal Reserve Banks indicates that there is plenty of money to meet the requirements of legitimate business.

Distributive trade is upon the whole quieter, and car loadings for the week are again smaller than they were for the corresponding period last year. The dry goods market has been a little less active, and hand to mouth buying is again the fashion. At the fall opening of the American Woolen Co., woolen suitings and overcoatings were priced at about 10 to 15 per cent under the figures of a year ago, but other goods showed only a small change.

Cotton goods are, if anything, slightly lower, and the raw cotton market is a shade easier, although futures have been sustained by the scarcity of tenderable cotton. But the poorer grades, which are supposed to represent about one-fifth of this year's crop, are again becoming difficult to move.

Statistically speaking, wheat and corn are in a strong position, but the larger speculators are deserting the option market as they are becoming fearful of the supervisory attitude that the Department of Agriculture is taking toward trading on the Chicago Board of Trade.

With the opening of the new exchange rubber seems to have been stabilized around 65 cents a pound, and the tire makers have reduced their prices by 10 per cent. The coffee market shows but little change.

Sugar has been conspicuously firm on rumors that the Java crop would be under expectations and that the production in the western provinces of Cuba would be less than expected.

The facts about the steel and iron industry are elusive, but the manufacturers who will talk admit that both demand and production are somewhat below expectations. Copper continues to hang around 14 cents, and the other important metals show little change.

A number of new industrial consolidations are in the making. One of them is a combination of chain-store consolidations already effected, and another, to be capitalized at a billion dollars, embraces several of the big baking companies recently put together. A proposal that part of its earnings shall be devoted to philanthropy is not seriously regarded, and Congress is threatening an investigation. A consolidation of 76 companies manufacturing cinder concrete blocks is also in process.

But all these schemes contemplate the sale of newly created securities to the investor, and some who are good judges of such matters feel that the investment demand for speculative securities is not as keen as it was. Certainly the stock market is less susceptible to bullish stimulus than formerly, and even the railroad stocks no longer respond as they did to the talk of the many consolidations that are now being considered by the Interstate Commerce Commission.

In any case the investment market appears to be approaching the digestive period and lethargy which always follows a hearty meal, and while general trade may not be much affected there are some indications that it may also become lethargic until the crops of 1927 are harvested and the money for which they are sold begins to circulate.

What's Doing in Industry

The month so far shows a continuation of improvement in machine tool and machinery sales. Inquiries sent out at the beginning of the year are already turning into actual orders and most localities report better conditions in industrial affairs.

Railroads are once again active buyers of equipment, Cincinnati reporting more orders from that source. The same news comes from Indianapolis, where lumber and wood-working industries are also in the market for tools.

Detroit sales still present a good volume, automobile plants buying tools as ways are found to increase production. Chicago sales are increasing, with railroads beginning to show interest in new equipment. Punches and shears are in demand in Cleveland.

The New England territory reports an upward trend in sales, accessory plants and railroads doing most of the buying. Small orders in large volume features business in Buffalo, while New York continues to show a steady improvement, both in sales and new inquiries. Mining and power plant activity in Canada is furnishing good business for machinery dealers.

The investment market appears to be approaching a condition of lethargy, and while general trade may not be much affected there are some indications that it may also become lethargic until 1927 crops are harvested and the money put into circulation.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Cincinnati

An increase in the volume of orders received in the past week is reported by Cincinnati machine tool manufacturers and selling agents. There was also an increase in the number of inquiries received.

The feature of the week's market was the purchases made by miscellaneous users of machine tools. The market has shown no indication of spottiness, it is stated, and orders and inquiries are well diversified as to sizes and types of tools. It is reported that conditions are improving in the Southwest, and the outlook in that territory is regarded as promising.

A few sales to railroads are reported, as well as additional inquiries from that source. A railroad list that is attracting great interest calls for equipment of a new shop, and it is thought that the order will be placed very soon. Other railroads are expected to buy extensively in the near future, as several other lists remain to be acted on.

Buying by concerns in the automotive industries increased slightly in the past week, and it is thought that the prospects in this field are good because greater manufacturing activity is reported from the various centers.

While a few purchases have been made for expansion, most are for replacement.

Milwaukee

Conditions surrounding the trade in metalworking equipment continue to improve, and with the betterment, manufacturers and dealers expect to experience improvement in the demand. This has been well maintained during the month of January and so far in February, although there have been no developments of a startling nature. Local industries engaged in manufacturing automotive units and parts, oil industry equipment, electrical apparatus andwoodworking equipment are buying tools, both for replacement and to enhance production, in a way that makes the late winter period of a year ago appear slow by comparison.

Most of the machine tool shops in this market are booked up for several months ahead, although few are using all of their existing capacity. One reason is that they are unable to procure all of the skilled labor they could use; another is that while the call for equipment is better than at any time in four to five years, the volume has not yet reached the point where capacity is put to extraordinary strain.

Detroit

Spurred with a determination to further perfect the present-day motor car, as a result of the annual meeting of the Society of Automotive Engineers recently, engineers in Detroit's leading automobile plants are already studying machinery and machine tool equipment with an eye for replacements to meet the constantly growing competition every manufacturer faces.

From leading representatives of machinery firms word comes that several of the larger plants are seriously considering extensions which will mean the placing of orders for new machines.

Detroit's body plants are gradually replacing machinery used to manufacture open bodies with additional equipment for the construction of closed jobs. Machine tool men anticipate considerable new business from the body plants during the current year.

There apparently is no material decline in automobile production, while as a matter of fact some plants are increasing their output. Cadillac and Oakland are buying equipment, the former making an attempt to tool up for a 30 per cent increase in production, and the latter trying to get set for quantity production on the new Pontiac. Packard is continuing the modernization of its equipment, motor-driven machines replacing all obsolete ones.

The first half of the year should be productive of good sales of machinery and machine tools, if the remaining five months are equal to January.

Cleveland

Business in the machinery and machine tool lines in this district continues on a steady upward trend. Sufficient business was booked in the past fortnight to warrant further predictions that the next three months will continue as active as the past three months. January sales equaled December business and the latter month was declared the best of the old year. The automotive industry in general is the chief buyer. Orders received indicate that tools are being used for expansions.

The punch and shear division reports business as being better than at any time in the past five years. One local producer of this type of tool is adding new machinery in order to speed up production.

Production is on the increase, many firms are working night shifts in order to complete present contracts and to clear the way for incoming orders.

Indianapolis

Further increases in demand for machine tools and machinery are noticed in this territory. The demand for tools seems to be larger in proportion than that for machinery. Much of this is due to the activity of the automobile and accessory plants here. Not for years has business been so good with these plants.

Railroad buying is picking up a little, but weather conditions and heavy traffic have prevented the roads from putting equipment in the shops for repair.

A good demand for tools comes from the lumber factories, where the trade is preparing for another good year. Demand for both machinery and tools is improving in the farm implement field.

January, this year showed a slight increase in business over the same month a year ago, the increase being estimated variously at between 10 and 15 per cent.

Dealers in used machinery report sluggishness in sales, but inquiries are many.

Chicago

The month of February so far shows no appreciable change in the machine tool market. Dealers generally report business fair with respect to the closing of sales, but inquiries are being received in greater number than at any time since the first of the year. This fact encourages them to believe that business in both new and used tools will improve as the year advances.

Manufacturers of wood-working machinery report an increased demand for their products, the month of January having been exceptionally good.

There is considerable inquiry for special grinding machines. Recent developments in the improved mechanical character of this line have attracted considerable attention among industries in which they are largely employed. While business in machine tools has fallen somewhat short of expectations thus far this year, it still is ahead of last year at this time. Much is expected from railroads, and a few of the big manufacturing plants within the Chicago district, and dealers express confidence that a better market will develop in the very near future.

The Florida & East Coast R.R., through Battey & Kipp, Chicago engineers, is in the market for 27 machine tools, together with other shop equipment. The Illinois Central, the Chicago & Northwestern, and the New York Central railroads are looked to for the bulk of this year's spring railroad business.

New York

Sales of machinery and machine tools in this market continue to improve, the month so far showing an active demand for single machines for special work and for replacing worn out or obsolete equipment.

Railroads have been quite active in inquiring for machines of various types.

Manufacturers of electrical and contractors' equipment are also in the market. Producers of structural steel and like products are busy and have come into the market for machinery for their special purposes.

Orders placed last week made a very satisfactory volume. Milling machines, many types of lathes, radial drills and presses went to general manufacturers, while railroads took car-wheel borers, cranes, axle-turning lathes and wheel presses.

Dealers in second-hand tools report an active demand for good used equipment, although they are not always able to provide the particular machines wanted.

Buffalo

The trend of activity continues on the increase since the first of the month. Final reports on the business of machine tool dealers for the month of January indicate a pronounced increase of business over that of January 1925.

Most of the orders continue to be small, usually for individual pieces of equipment, or for a few pieces at a time. But the total number of such orders bulks rather large. General industry continues highly active in this territory and the condition of the machine tool trade reflects this activity. There has been some increase in the demand for small tools in recent weeks.

There is little or no activity in railroad or contractor buying. The activity in electrical equipment is keeping pace with that of machine tools and parallels it in most of its aspects, the individual orders being generally small but the sum total large.

Canada

An upward trend in the machinery and machine tool business in Canada is in evidence. Dealers report that business during January was better than for several years. Expansion in the Northern mining fields, notably at Hollinger where orders are being placed for three additional rod mills

and where considerable tank construction is now under way, is bringing much business to metal-working plants. The Ontario Steel Products Co. reports that business in the spring and axle plants is increasing to such an extent that it may be necessary to operate overtime.

The Ontario Hydro Electric Power Commission has announced plans for the development of Alexander Falls on the Nipigon River, Northern Ontario, at an estimated cost of $7,000,000. The International Paper Co. will shortly commence work on a huge power plant at Farm Point, on the Gatineau River, near Ottawa, Canada.

The metal working industry is looking forward to considerable business from the construction field. In the city of Toronto alone it is expected that from $27,000,000 to $30,000,000 will be spent on construction during 1926.

New England

Further activity in buying, especially by the automotive trade, is noted in the New England section. A better demand comes from builders of machinery and contractors making automobile parts. There is also substantial business coming from manufacturers of agricultural machinery and equipment. The improvement is not large, but it serves to keep the business curve inclining upward.

Most of the machinery orders are for replacements and the nature of the inquiry mail is such as to indicate that this business will represent a large bulk of the immediate future demands.

Special machinery builders report that there is an unusually large volume of orders in prospect, while at the same time the amount on the books requires full-time operations, and overtime where it is possible to get employees to work.

Good buying by railroads is being experienced. Textile machinery business is slightly improved.

What the Railroads Are Doing

Several large inquiries for railroad equipment are in the market. The Seaboard Air Line has revised its inquiry and is now asking bids on 3,000 to 4,500 gondolas and box cars and the Southern Pacific for 1,100 box and 500 gondolas. The Missouri Pacific, which ordered 50 gondolas from the Pressed Steel Car, is expected to order 600 box car bodies; the Chicago & Eastern Illinois wants 500 hoppers; the Central Railroad of New Jersey 25 passenger cars and the Siam State Railways 150 steel goods wagons. The Chicago, Indianapolis & Western, and the Chicago, Milwaukee & St. Paul are expected to buy 500 to 1,000 cars each shortly. The Fruit Growers Express has just purchased 300 steel underframes from the Ryan Car Co.

The Western Pacific R.R. has ordered five Mikado type locomotives from the American Locomotive Co. and the Norfolk-Southern five consolidation type engines from the Baldwin Locomotive Works.

The Southern Pacific R.R. has ordered 10,000 tons of rails from the Tennessee Coal, Iron and Railroad Co., and the Missouri Pacific has ordered 5,500 tons from the same company and 4,500 tons from the Illinois Steel and Inland companies.

The Minneapolis, St. Paul & Sault Ste. Marie is expected to enter the market for about 10,000 tons of rails and 5,000 tons of tie plates, and the Chicago, Burlington & Quincy for 7,000 tons of tie plates and 3,000 tons of splice bars.

The Pacific Fruit Express has ordered 5,043 refrigerator cars, divided 1,043 to the Pullman Car and Manufacturing Co. and 1,000 each to the General American Tank Car Co., the Standard Steel Car Co., the Pacific Car and Foundry, and the American Car and Foundry Co. The total cost is approximately $16,000,000.

The Baltimore & Ohio R.R. has purchased 1,000 hopper cars from the Standard Steel Car Co., and 1,000 from the Bethlehem Steel Corporation and has ordered forty passenger cars from the Pullman Car and Manufacturing Co., eighteen passenger cars from the American Car and Foundry Co., and fifteen from Bethlehem Steel.

The Union Pacific ordered 500 ballast and thirty passenger cars from the Pullman Car and Manufacturing Co., 500 ballast and seventeen passenger cars from the American Car and Foundry, 700 automobile cars from the General American Tank Car Co. and 300 automobile cars from the Pennsylvania Car Co.

News of the Automotive Industries

The Buick Motor Co. has reported the best January in its history, with sales and production of approximately 24,000 cars.

Actual retail deliveries have closely followed production. Buick will continue through February, March and April at a larger production rate than in January.

John N. Willys commenting on results at the various automobile shows, says: "We have been extremely successful at the shows. Actual retail sales at all shows average from 100 to 150 per cent increase over last year. We are getting our production up to 1,000 a day this month and March. We are planning on 1,200 a day for April and 1,350 for May."

The Hupp Motor Car Corporation last month produced 4,343 cars, compared with 2,599 last year. This is the largest January in history of Hupp.

Henry J. Fuller, president of Rolls-Royce of America, Inc., has been elected chairman of the board of Brewster & Co.; William Brewster is president, W. E. Hosac, vice-president of Rolls-Royce is vice-president in charge of sales; H. C. Beaver is treasurer and vice-president and P. B. Brewster is assistant treasurer and secretary.

New records were established for Dodge Bros. dealers' retail sales, retail deliveries, and factory shipments in January. Retail sales in the United States were 19,218 cars and deliveries were 14,943 cars, an increase of 58 per cent and 67 per cent, respectively, over the same period in 1925. Retail sales are running ahead of deliveries, although production schedule was close to 1,100 cars a day during January. The company expects to increase production to 1,500 cars daily before the end of February.

The Ford Motor Co.'s St. Paul factory will begin quantity production of plate glass and batteries this month. Heretofore it has been used only for assembling cars. Present plans call for 10,000 sq.ft. of plate glass, 2,000 storage batteries and 1,000 radiators a day, with increases in output expected after six months.

The Hudson Motor Car Co. produced 20,000 cars in January, approximately the same as in December. Schedule for February is 20,000 cars, but beginning March 1, the company plans an output of 1,500 cars a day or 40,000 cars a month.

E. L. Cord has been elected president and general manager of the Auburn Automobile Co., succeeding J. I. Farley, resigned. Mr. Cord has been vice-president for a year and a half. Roy H. Faulkner was elected vice-president, L. G. Manning treasurer and Raymond S. Pruitt, secretary.

The latest figures on automobile production in Canada during 1925 are those for the ten months, January to October, which show an output of 141,137 vehicles valued at $93,997,242. These figures compare with 132,580 vehicles valued at $88,480,118, for the whole of 1924.

Manufacture of automobiles will be commenced in Balboa, Spain, shortly by the Compania Euakalduna de Construcdion y Navagacion de Euques who expect to place the first cars on the market about March 1, 1926. Plans call for manufacture on a large scale. The motor will be of Spanish design of the four-cylinder type with low fuel consumption and reasonable selling price.

Automobile importations into South Africa for the first half of 1925, reached a new high record of 9,161 cars, valued at £1,530,060 as compared with the previous high mark in the first six months of 1924 when 7,230 cars entered the Union. It is believed that the 1925 total reached 16,000 or 17,000 cars, which is about 25 per cent above the 1924 record total of 13,461 which exceeded the 1923 record of 10,151 by about 33⅓ per cent.

Management Course at Columbia

Principles and practices of factory management and practical machine design will be taken up in two courses to be given by the Department of Industrial Engineering of Columbia University, New York, in the spring term. Walter Rautenstrauch, professor of industrial engineering, will direct the first, and William S. Ayars, associate professor of industrial engineering, the second.

Personals

R. S. JONES, formerly with the Cincinnati Planer Co., is now on the sales staff of the Barney Machinery Co., of Pittsburgh.

F. J. GRIFFITHS has been elected chairman of the board of directors of the Central Steel Co., of Massilon, Ohio.

ISAAC WILKOFF has been elected a director of the Youngstown Foundry and Machine Co., Youngstown, Ohio.

CHRISTOPHER J. MOGAN, for the past twenty-six years associated with the Pittsburgh Steel Co., has resigned.

CHARLES E. BARBA has been appointed mechanical engineer for the Boston & Maine Railroad.

R. H. DOUGHERTY has been appointed assistant general manager of the United Alloy Steel Corporation, Canton, Ohio.

ROBERT J. BELER has recently joined the Pittsburgh sales office of the Foote Bros. Gear and Machine Co., as assistant to W. G. Kerr, district representative.

M. R. BEMBOWER has been appointed general manager of the Elyria Manufacturing Co., of Elyria, Ohio, manufacturer of machine screw products.

GEORGE W. BURRELL will retire this month as vice-president and assistant general manager of the Wellman-Seaver-Morgan Co., of Cleveland.

O. A. BLOOMQUIST is now associated with Leonard R. Nourie, of Pittsburgh, as district representative of Jos. T. Ryerson Sons, Inc., and of the Niagara Machine and Tool Co., of Buffalo.

JAMES ASTON has been appointed professor of mining and metallurgy at the Carnegie Institute of Technology. He was formerly associated with the A. M. Byers Co., of Pittsburgh.

VINCENT W. MCAULIFFE, purchasing agent for the Hart & Hegeman Manufacturing Co., of Hartford, Conn., has resigned to become Connecticut representative for the Continental Fiber Co.

I. MOEHLER, formerly superintendent of the Eastern Car Co., New Glasgow, Nova Scotia, has been appointed general superintendent and chief engineer of the Nova Scotia Steel and Coal Co. and of the Eastern Car Co. He succeeds John Fraser.

EDWARD A. DEEDS has been elected chairman of the board of the Niles-Bement-Pond Co., of New York. Mr. Deeds succeeds R. K. Le Blond. J. V. Forrestal, of Dillon, Read & Co., was elected to the board. Other officers of the company were re-elected.

Business Items

The United States Electric Tool Co., of Cincinnati, has opened an office in Toronto, Canada, in charge of K. D. McColl, who will devote his whole time to the industrial and automotive fields.

The Plainville Manufacturing Co., Plainville, Conn., manufacturer of lock washers, has moved into the new addition to the Root plant on Church St., Bristol, where better facilities for manufacture are offered.

The Braeburn Alloy Steel Corporation announces the opening of a general sales office in the First National Bank Bldg., Pittsburgh, Pa. H. Oliver Williams, vice-president in charge of sales, will direct this office.

In the annual report of the Massey-Harris Co., makers of agricultural implements, it is stated that the company contemplates the erection of a plant near Lille, France.

The Charles A. Strelinger Co., of Detroit, has taken over the exclusive sale of the line of standard metal-working machinery consisting of boring mills, heavy service drills, rail drills and valve grinding machines manufactured by the Defiance Machine Works, of Defiance, Ohio.

The Kearney & Trecker Corporation of Milwaukee, has opened a new branch office in Indianapolis, with headquarters at Room 614, Traction Bldg. Robert W. Ott, formerly connected with the Chicago office, will be in charge.

The Sea Sled Co., Inc., Mystic, Mass., recently organized, has acquired part of the plant of the Groton Iron Works, New London, Conn., and has started the manufacture of sea sleds. Paul G. Zimmerman is general manager. The Groton plant will be used as an assembly unit.

The plant of the Cincinnati Electrical Tool Co., formerly at Freeman Ave., and Flint St., Cincinnati, has been consolidated with the plant of the R. K. Le Blond Machine Tool Co., at Madison and Edwards Roads, where the manufacture of the line will be continued. The electrical tool company retains its corporate identity.

The Ex-Cell-O Tool and Manufacturing Co., of Detroit, has appointed as its representative for the state of Wisconsin, the firm of Williams, Cole & Wolff, of Milwaukee. The company has also appointed the Hausman-Harwick Machine Tool Co., of Birmingham, Ala., as sales representative for the State of Alabama.

The National Tool Salvage Co. has been organized at Detroit. The company was formed by the merger of the National Grinding Co., Inc., and the Tool Salvage Co., both of Detroit. Officers of the new organization are: Harry M. Lewis president: Hiram Ash, vice-president; O. L. Hatt, treasurer: A. J. Moquin, secretary; Frank Price, chairman of the board.

The Lapham-Hickey Co. has been organized at Chicago, with offices at 1625 Pershing Road. The company was formed by former employees of the Fitzsimons Steel and Iron Co., and the Edgar T. Ward's Sons Co. Edward B. Lapham is president of the company; Frank E. Hickey is vice-president and treasurer; and Robert P. Lapham is secretary. The company will deal in finished steel in bars, strips, rods and sheets.

Obituaries

CHARLES MCKNIGHT, former president of the Carbon Steel Co., of Pittsburgh, died in Atlantic City on Jan. 28.

CHARLES A. WOLFE, one of the founders of the Baird Machine Co., of Pittsburgh, died at his home in that city on Jan. 26. He was 66 years old.

A. PARKER NEVIN, since 1912 secretary and a director of the Watson Stillman Co., New York, died on Feb. 2 after a few days' illness.

SAMUEL D. LATTY, founder and president of the Kirk-Latty Manufacturing Co., of Cleveland, died on Jan. 31. He was 61 years old.

GEORGE A. EHRMANN, scientist and inventor, and head of the research department of the Mesta Machine Co., of West Homestead, Pa., died at his home in Pittsburgh on Feb. 1.

WILLIAM P. CHAMPNEY, well-known in the steel and machinery industry in Cleveland, died in Florida on Jan. 31. Mr. Champney was at one time president of the Eberhard Manufacturing Co.

Catalogs Wanted

The Trust and Agency Co., of Australia, Ltd., representative of The Compania Argentina de Hierros Aceros, at 3075 Cochamba, Buenos Aires, would like to receive catalogs from American manufacturers of machinery and metal-working equipment.

Trade Catalogs

Diamond Drills. Sullivan Machinery Co., 122 South Michigan Ave., Chicago, Ill. "Structure Finding and Diamond Drills" is the title of booklet No. 125, containing notes on geological tests in the mid-continent field, by Kay Peters, of Garber, Okla. The booklet explains the method of geologic exploration for which diamond drilling is especially suitable. Many cross-sections of strata illustrate the text.

Gear Reducers. Foote Bros. Gear & Machine Co., 215 North Curtis St., Chicago, Ill. A small circular has been prepared by this company to show the outstanding features of continuous tooth herringbone speed reducers. Three models are included in the description.

Pamphlets Received

The Composition and Structure of Iron and Steel. Published by the Republic Flow Meters Co., Chicago, Ill. Article 3 of the series on "Steel and Its Heat-Treatment." This article was written by H. M. Boylston, consulting metallurgist and head of the metallurgical and mining engineering department, Case School of Applied Science. The article covers the difference between iron and steel and the micro-structure of pure iron in relation to the heat-treatment of steel. Micro-photographs illustrate the formation and growth of crystalline grains.

Present Day Merchandising. No. 6 of the series on "Management Methods." Published by the Policyholders' Bureau of the Metropolitan Life Insurance Co., 1 Madison Ave., New York, N. Y. The leaflet outlines the four main phases in the development of modern merchandising: the era of daring and indiscriminate buying, the era of more systematic buying according to definite appropriations, the development of subdivisions to control stocks and purchases and the perpetual inventory.

Organization of the Functions of the Controller. By Arthur Lazarus. Financial Executives' Series, No. 8. Published by the American Management Association, 20 Vesey St., New York, N. Y. This booklet contains an address of the author delivered before the financial executives of the American Management Association. It covers the function of the controller in a life insurance company, in the United States Post Office, the United States Army, the city of New York, a bank, a railroad, a retail organization and a manufacturing company.

Winter Recreation for Employees. Report No. 82. Published by the Policyholders' Service Bureau—Group Division, of the Metropolitan Life Insurance Co., 1 Madison Ave., New York, N. Y. The report is based on the methods used by seventy-three companies in providing winter recreation for their employees. Indoor sports provided include bowling, boxing, wrestling and swimming. The outdoor sports include hockey, skating, skiing and hiking. Successfully organized glee clubs, bands and string orchestras are discussed.

Calendar of Local Meetings

National Association of Cost Accountants

Philadelphia. Feb. 12. Bellevue-Stratford Hotel. "Industrial Insurance."

Mohawk Valley. Feb. 15. "Plant and Equipment Budgets."

Twin Cities. Feb. 16. "Taxes as a Cost."

Hartford. Feb. 16. Visit to plant of Hartford Rubber Works; dinner and meeting in evening.

Los Angeles. Feb. 16. "Income Tax," by R. B. Goodsell, collector of Internal Revenue.

Rochester. Feb. 17. "Administrative and Selling Costs," by W. B. Castenholz.

Syracuse. Feb. 17. "Cost Information from the Foreman's Viewpoint."

Chicago. Feb. 18. City Club. "Planning for Reduced Production Costs."

Milwaukee. Feb. 19. "Standard Classification of Accounts."

San Francisco. Feb. 22. "How Can the Engineer and the Cost Accountant Co-operate for Better Management?"

Scranton. Feb. 23. Scranton Club. "Changes in the 1925 Revenue Act."

Boston. Feb. 25. "Some Debatable Points in Cost Accounting," by Clinton H. Scovell.

Buffalo. Feb. 25. "Distribution Costs."

Detroit. Feb. 25. "Computing and Distributing Power Costs."

American Society for Steel Treating

Hartford. June. Spring sectional meeting.

American Society of Mechanical Engineers

Eastern New York, at Schenectady. Feb. 12. Joint meeting with the A. I. E. E. Speaker, Mr. Eveleth, of the General Electric Co.

Society of Automotive Engineers

Southern California Section. Feb. 12. "Engine Cooling by Radiators and Steam Cooling Systems," by G. A. Dockeray and Paul Zering.

Cleveland Section. Feb. 15. "Automobiles of Today and Tomorrow," by Herbert Chase.

Metropolitan Section. Feb. 18. "The Outlook for Bus Transportation in New York City," by F. V. Lane, D. J. Locke and Alexander Shapiro.

Chicago Section. Feb. 19. "Soothing the Internal Combustion Engine," by Professor Daniel Roesch.

Buffalo Section. Feb. 23. "Progress in Airplane Engine Design," by Arthur Nutt.

Detroit Section. Feb. 25. "Airplane Engine Maintenance," by Lieut. Cyrus Bettis.

Forthcoming Meetings

American Management Association. Annual convention, Hotel Astor, New York City, March 3, 4 and 5. Headquarters, 20 Vesey St., New York City.

National Railway Appliance Association. Annual meeting and exhibition, Coliseum and Annex, Chicago, March 8 to 11th. C. W. Kelley, secretary, 845 So. Wabash Ave., Chicago.

National Foreign Trade Council. Thirteenth national foreign trade convention, Charleston, S. C., April 28, 29 and 30. O. K. Davis, secretary, India House, Hanover Square, New York.

American Gear Manufacturers' Association. Tenth annual meeting, Book-Cadillac Hotel, Detroit, May 13, 14 and 15. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Supply and Machinery Manufacturers' Association. Annual convention, Hotel Statler, St. Louis, week of May 17. F. D. Mitchell, secretary, 1819 Broadway, New York.

National Association of Purchasing Agents. Eleventh annual convention and exposition, Ambassador Hotel and Auditorium, Los Angeles, Calif., June 9 to 12. W. L. Chandler, secretary, Woolworth Bldg., New York.

American Society for Testing Materials. Twenty-ninth annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 21 to 25. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig-iron market shows little tendency to change from present levels despite advance in fuel; buying for second quarter slow; reserve stocks limited. Steel prices unchanged during week with most of the buying in railway materials and structurals; mills active on old orders. During past week, mill quotations on principal hot-rolled items, were: bars, $2; shapes, $1.90@$2; plates, $1.80@$1.90 per 100 lb., f.o.b. Pittsburgh.

Non-Ferrous Materials—Compared with the Jan. 28 price level, copper and lead remain unchanged; tin is up 1¼c. per lb.; antimony is down 1½c., babbitt metal 1c., solder ½c., zinc ¼c., and linseed oil 0.1c. per lb. Fabricated brass and copper reflect conditions in the metals and there is considerable fluctuation in non-ferrous scrap.

(All prices as of Feb. 5)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.05
Northern Basic	24.27
Southern Ohio No. 2	24.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.37
BIRMINGHAM	
No. 2 Foundry	22.00@23.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.16
Virginia No. 2	29.17
Basic	23.16
CHICAGO	
No. 2 Foundry local	23.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	26.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	22.27
Basic	22.27
Bessemer	22.27

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.50
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.50	3.89	3.25	3.50
No. 12	2.55	3.94	3.30	3.55
No. 14	2.60	3.99	3.35	3.60
No. 16	2.70	4.09	3.45	3.70
Black				
Nos. 18 to 20	3.15	4.30	3.90	3.90
Nos. 22 to 24	3.20	4.35	3.95	3.95
Nos. 26 and 27	3.25	4.40	4.00	4.00
No. 28	3.35	4.50	4.10	4.10
Galvanized				
No. 10	3.60	4.50	4.25	4.25
Nos. 12 to 14	3.70	4.60	4.35	4.35
No. 16	3.85	4.75	4.50	4.50
Nos. 18 to 20	4.00	4.90	4.65	4.65
Nos. 22 to 24	4.15	5.05	4.85	4.80
Nos. 26 and 27	4.30	5.20	5.10	4.95
No. 28	4.60	5.50	5.25	5.25

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameters Inches — External	Diameters Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches — ⅛	¼	⅜	½	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.25	6.35	6.80
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.10
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	50@60%	55%	60%

Electric welding wire, New York, 3/32, 8.25c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb. *Flat, 1/16@½-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.00
Tin, 5-ton lots, New York			64.25
Lead (up to carlots) E. St. Louis	9.12½	New York	9.75
Zinc (up to carlots) E. St. Louis	8.10	New York	9.25

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	23.50	24.50	26.00
Copper sheets, base	22.50	22.50	22.50
Copper wire, base	19.62½	16.50	16.25@16.50
Copper bars, base	22.12½	22.37½	22.12½
Copper tubing, base	24.25	24.50	24.50
Brass sheets, base	18.87½	18.62½	19.12½
Brass tubing, base	23.50	23.25	23.75
Brass rods, base	16.62½	16.50	16.87½
Brass wire, base	19.37½	19.12½	19.62½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	27.00	27.00	27.02
Zinc sheets (casks)	12.00	12.60@12.95	12.27
Solder (⅓ and ½), (case lots)	39.25	41.00	38@42
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade	78.00		
Commercial genuine, intermediate grade	56.00		
Anti-friction metal, general service	31.50		
No. 4 babbitt (f.o.b.)	14.50		
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 31 00 Electrolytic 38.00 Shot	32.00		

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50 00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.00@12.25	11.25	11.25@11.75
Copper, heavy, and wire	11.00@11.75	11.50	11.00@11.50
Copper, light, and bottoms	9.75@10.25	9.50	10.00@10.50
Heavy lead	8.00@ 8.37½	7.50	7.75@ 8.25
Tea lead	6.25@ 6.50	5.00	6.75@ 7.25
Brass, heavy, yellow	7.25@ 7.75	7.25	7.50@ 8.00
Brass, heavy, red	9.50@10.00	9.50	8.50@ 9.00
Brass, light	6.00@ 6.25	6.00	7.00@ 7.50
No. 1 yellow rod turnings	8.50@ 9.00	8.00	7.50@ 8.00
Zinc	4.50@ 5.00	4.75	5.00@ 5.50

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.25	$11.45	$11.50
"A" Grade:				
IC,	14x20	8.85	9.40	9 50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.85	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.20
Cotton waste, colored, per lb.	.10@ .15½	.10	.17
Wiping cloths, washed white, per lb	.18	36.00 per M	.16
Sal soda, per 100 lb. keg	2.25	2.25	2.75*
Roll sulphur, per 100 lb. keg	3.75	3.35	4.50
Linseed oil, per gal., 5 bbl. lots	.88½	1.05	.90
Lard cutting oil, 25% lard, per gal.	.55	.50	.56
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*In 175 lb. kegs.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.0415
Brass rods	per lb	.1662½	.1687½	.1762½
Solder (½ and ½)	per lb.	.3925	.4025	.42
Cotton waste	per lb.	.15@.22	.15@.22	15@22
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.38
Lard cutting oil	per gal.	.55	.55	.60
Machine oil	per gal.	.35	.35	.29
Belting, leather, medium	off list	40–5%	40–5%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.56	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	29.48	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.45	1.49
Cloth	3.55	3.55	3.20
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton 10.00@11.00		
Coke, prompt foundry, Connellsville	per net ton 10.50@11.00		
White lead, dry or in oil	100 lb. kegs	New York, 15.25	
Red lead, dry	100 lb. kegs	New York, 15.25	
Red lead, in oil	100 lb. kegs	New York, 16.75	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{7}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x½-in., 2c. each. Discount 70% for $\frac{7}{16}$-in and smaller and 65% for ½-in. and larger.
Case hardened ¼x½-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ⅞-in., 1-in. diam. x2¼-in. to 4½-in. $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb for 1½ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ¾-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ⅜-in., $7.00* per 100 lb. at New York warehouses; ½-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ark., Little Rock—Ketcher Mfg. Co., Inc., 1601 Main St.—machinery for the manufacture of sheet metal.

Mich., Detroit—A. & G. Tool & Die Co., 1052 Morrell St.—(die making)—30 x 30 x 8 ft. metal planer.

Mich., Detroit—Bd. of Education, 1354 Broadway Ave., C. A. Gadd, Bus. Mgr.—4 electric furnaces and equipment, type F. H. 206.

Mich., Detroit—Chevrolet Motor Co., 3044 West Grand Blvd.—equipment for service station in connection with the 3 story, 150 x 150 ft. garage on Amsterdam Ave. Estimated cost $160,000. A. Kahn, 1000 Marquette Bldg., Archt.

N. Y., Buffalo—W. P. Stranahan, 15 East Pickham St. (auto parts, fenders, etc.)—small lathe, drill press and miscellaneous tools.

Tex., Texarkana—Southern Ice & Utilities Co., J. E. Ritchie, Gen. Mgr.—lathes, engine, dynamo and other machinery for proposed 75 x 140 ft. machine shop and supply plant to replace fire loss. Estimated cost $40,000.

Wis., Milwaukee—Delta Mfg. Co., 858 3rd St. (metal specialties)—10 in. milling machine with dividing head.

Opportunities for Future Business

Calif., Los Angeles—Advance Auto Body Works, 515 Mission Road, is receiving bids for the construction of 2 story, 125 x 145 and 30 x 40 ft. factory buildings at Mission Road and Macy St. Estimated cost $125,000. H. E. Bean, Central Bldg., Archt. Noted Jan. 28.

Calif., San Francisco—Dunn-Williams Co., 156 Montgomery St., plans the construction of an 8 story garage at Sutter and Powell Sts. Estimated cost $300,000. Architect not selected.

Colo., Colorado Springs—W. A. Otis & Co., 127 East Pikes Peak Ave., have acquired the Colorado Springs Electric Co.'s plant and plan the construction of additions to same for the manufacture of special hard steel high speed tools.

Conn., Torrington—Progressive Mfg. Co., 52 Norwood St., manufacturers of machine screws, rivets, etc., will build a 2 story, 55 x 141 ft. addition to factory. Estimated cost $40,000. W. E. Hunt, 182 Church St., Archt. Noted Feb. 4.

Ga., Atlanta—C. A. Sisson, c/o C. D. Crockett & Co., 316 Bona Allen Bldg., general contractors, awarded contract for the construction of a 3 story garage and service station. Estimated cost $200,000.

Ind., Elkhart — Henry Weis Mfg. Co. manufacturers of book cases, cabinets, etc., plans the construction of a 1 story factory.

Ind., Indianapolis—Alabama & Market Realty Co., awarded contract for the construction of a 4 story, 60 x 195 ft. garage. Estimated cost $150,000.

Ind., Indianapolis — Thomas L. Green & Co., 202 Miley Ave., will receive bids until Feb. 13 for the construction of a 2 story, 22 x 123 ft. factory for the manufacture of biscuit machinery. Estimated cost $40,000. C. E. Bacon, 605 Odd Fellow Bldg., Archt.

Ind., South Bend—George Cutter Co., is having preliminary plans prepared for the construction of a group of buildings including foundry, machine shop, assembly building, etc., at South Notre Dame Ave. Estimated cost $1,000,000. B. H. Prack, 119 Federal St., Pittsburgh, Pa., Archt.

THE "SEARCHLIGHT" pages of *American Machinist* offer each week innumerable opportunities of interest to companies, executives and others throughout the machinery field. They range from employment offered and wanted to entire plants and properties for sale including opportunities for new sales connections, patents for sale, new lines to manufacturer, equipment bargains, etc., etc.

You will do well to form the habit of checking these pages each issue.

Md., Baltimore—F. N. Iglehart & Co., 11 East Lexington St., plans the construction of a 6 story, 100 x 100 ft. garage on Water St. Estimated cost $300,000. Architect and engineer not selected.

Mass., Quinsigamond (Worcester P.O.)—American Steel & Wire Co., C. S. Marshall, Gen. Mgr., plans the construction of a billet and rod mill. Estimated cost $1,000,000.

Mass., Reading — Electric Dept., Town Hall, plans the construction of a garage and workshop. Estimated cost $40,000 to $50,000.

Mich., Detroit—Budd Wheel Corp., Charlevoix Ave., awarded contract for the construction of a 61 x 414 ft. addition hub building and 122 x 412 ft. addition to press building, both 1 story. Noted Oct. 29.

Mich., Detroit—Cadillac Motor Car Co., Clark Ave., is receiving bids for the construction of a 4 story, 56 x 321 ft. office building and a 60 x 275 ft. garage. A. Kahn, 1000 Marquette Bldg., Archt. Noted Dec. 17.

Mich., Detroit — Dept. of Public Works will receive bids until Feb. 17 for the construction of a 1 story, 37 x 37 ft. shop for asphalt plant at Western Yard. P. A. Fellows, City Hall, City Engr.

Mo., St. Louis—Century Electric Co., 1827 Pine St., has acquired an 8 acre site and plans the construction of a plant for the manufacture of electrical machinery, fans, etc. at Forest Park Blvd.

N. J., Newark—L. Singer, 19 Brunswick St., awarded contract for the construction of a 1 story garage on South St. Estimated cost $60,000.

N. Y., New York — Stewart Warner Speedometer Corp., 1826 Diversey Blvd., Chicago, Ill., awarded contract for the construction of a 4 story, 90 x 100 ft. addition to factory at 37 West 65th St., here. Estimated cost $125,000.

O., Cleveland—Cleveland Automobile Co., J. J. Krall, Secy. and Treas., London Road, awarded contract for the construction of a 4 story addition to factory. Estimated cost $200,000. Noted Feb. 4.

O., Cleveland—Owen Bucket Co., W. H. Botten, Pres., Rockefeller Bldg., will soon award contract for the construction of a 1 and 2 story, 90 x 180 ft. factory and office building on West 58th St. Estimated cost $75,000. George S. Rider Co., Century Bldg., Archt. and Engr.

O., Cleveland—The U. S. Air Compressor Co., R. L. Bacher, Pres., 5300 Harvard Ave., awarded contract for the construction of a 1 story, 80 x 90 ft. addition to factory. Estimated cost $40,000.

Pa., Pittsburgh—Locomotive Stoker Co., 30 General Robinson St., is having plans prepared for the construction of a 1 story, 30 x 180 ft. addition to plant on Robinson St. Hunting, Davis & Dunnello, 1150 Century Bldg., Engrs.

Pa., Pittsburgh—Wm. Penn Garage Co., 616 Webster Ave., awarded contract for the construction of a 9 story, 90 x 140 and 45 x 60 ft. garage. Estimated cost $750,000.

Tenn., Chattanooga — Simplicity System Co., L. B. West, Pres., Volunteer Bldg., plans the construction of a 1 story foundry and machine shop. Engineer not selected.

Wash., Seattle—Pacific Coast Forge Co., Inc., 3800 Iowa St., manufacturers of spikes and bolts, awarded contract for the construction of four 1 story, 52 x 185, 62 x 120, 35 x 75 and 35 x 62 ft. additions to plant. Estimated cost $100,000.

Wis., Marshfield—Bd. of Education will receive bids until Feb. 23 for the construction of addition to Purdy vocational and junior high school. Estimated cost $125,000. Parkinson & Dockendorff, La Crosse, Archts.

Wis., Milwaukee — The Dunham-Keith Co., manufacturers of engine cylinders, awarded contract for the construction of a 55 x 80 ft. addition to shop at 26th and Greves Sts.